THE COMMON COMMERCIAL TIMBERS OF INDIA AND THEIR USES

BY

H. TROTTER

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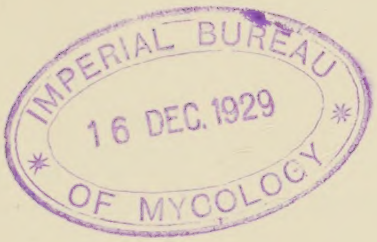

The COMMON COMMERCIAL TIMBERS of INDIA

and their uses.

By

H. TROTTER, I.F.S.,

Forest Economist, Forest Research Institute, Dehra Dun.

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F. R. I. Photograph.

The new Forest Research Institute at Dehra Dun. The roof on this building is covered with creosoted shingles of *chir* pine (*Pinus longifolia*).

PREFACE.

A great deal has been written, of late years, concerning the "vast forest wealth" of India. The fact remains, however, that except for teak and a few parcels of other timbers from Burma, Madras, and the Andamans, there is practically no export of timber from this country. In the same way, the Indian markets concentrate on teak, sal, deodar and a few other well-known woods, while local craftsmen content themselves with the cheapest timber available, whether suitable for the purpose for which it is intended or not.

This state of affairs could be understood, when the prices of the well-known woods were low, but during the past decade prices have risen considerably, and in some cases are now almost prohibitive to the consumer. Even the large timber users like the Railways, the Ordnance Department, and the Public Works Department began to grow anxious when the price of teak rose to a figure which was beyond all thought fifteen years ago. As a sequel to this unsatisfactory state of affairs, the Railway Board, in 1924, inaugurated an enquiry to investigate the possibility of using timbers other than teak for railway carriage and wagon building and for repairs. The results of this enquiry are recorded in Mr. H. G. Norman-White's Report, published by the Oudh and Rohilkhand (now the East Indian Railway) Press, Lucknow, in February, 1925.

As this report was a Railway Board publication and was not available, in a general way, to the public, it was considered that a similar treatise, published by the Forest Research Institute at Dehra Dun, and dealing, not only with timbers suitable for railway work, but also with those woods considered suitable for the general use of Indian timber merchants, both large and small, might serve a useful purpose.

This, then, is the *raison d'être* of this publication.

At the same time, it has become more and more evident that the technical literature on Indian timbers, published from time to time by the Forest Research Institute, rarely attracts the ordinary layman, and is little read even by timber merchants themselves.

Every effort has been made, therefore, to make the present publication as simple as possible, and it is hoped that it will help to supply a much needed want to the trade.

In this connection, it is only right to mention that Mr. R. S. Pearson, late Forest Economist, published a similar booklet in 1912, namely "A Commercial Guide to the Forest Economic Products of India." This was well received by the trade, and was of invaluable help to many who had known little of the subject. Sixteen years have now passed since that first Commercial Guide was published, and it is by way of bringing Mr. Pearson's Guide, as far as timbers are concerned, up to date in an improved form that the present work is placed before the public.

Before passing on to the book itself, a special word of warning with regard to SEASONING will not be out of place. The use of unseasoned wood has been the chief stumbling-block to the adoption of India's lesser known timbers, and the importance of proper seasoning cannot be over-emphasized.

A special chapter on air-seasoning, in simple language, has therefore been included in this publication, and if this helps, even in a small way, to eradicate the prehistoric drying methods now carried out by most timber merchants in this country, and to replace them with the simple but no more expensive methods described, then the author will feel more than repaid for his share in this publication.

In conclusion, the attention of the public is drawn to the fact that the new forest products laboratories at Dehra Dun are now the largest, and probably the best equipped, of any Forest Research Institute in the world, and the advice and experience of the many specialists employed there are always at the disposal of timber users and others, whether large or small, without any charge. Interested parties are, therefore, strongly urged to write to the Forest Economist, Forest Research Institute, Dehra Dun, whenever they require advice or help in any matter connected with the utilization of Indian timbers or other forest products.

BIBLIOGRAPHY.

1. A Manual of Indian Timbers, by J. S. Gamble.

2. Commercial Guide to the Forest Economic Products of India, by R. S. Pearson.

3. Report on certain Indigenous Timbers of India, Burma and the Andamans considered suitable for Railway Carriage Building, 1924-25, by H. G. Norman-White.

4. Indian Forest Records, Vol. IX, Part V. Further Experiments in the Air-Seasoning of Indian Timbers and General Recommendations as to Seasoning Methods, by C. V. Sweet.

5. Forest Bulletin (Economy Series) No. 66 of 1925. A note on the working qualities of some common Indian Timbers, by H. E. Kinns.

6. Timbers of the World, by A. L. Howard.

The table of strength values given on page 144 was compiled by Mr. L. N. Seaman, M.A., B.Sc., M.E.I.C., Officer in Charge, Timber Testing Section, Forest Research Institute, Dehra Dun.

Acknowledgments are also due to the following officers of the Forest Research Institute, namely Mr. L. N. Seaman, Officer in Charge, Timber Testing Section, Dr. S. N. Kapur, Officer in Charge, Seasoning Section, and Mr. S. Kamesam, Assistant, Wood Preservation Section, for their help in supplying information and for checking those portions of the publication which refer to their sphere of work.

F. R. I. Photograph.

The log pond at the Forest Research Institute.
This pond holds about 300 average size logs.

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CHAPTER I.

Storage of Logs.

Most purchasers of timber in India obtain their supplies of wood in the form of logs. It may not be out of place, therefore, if a few words of advice are offered regarding the storage and protection of logs before they are converted.

It is a popular belief that timber can be seasoned in log form as quickly and easily as it can in the form of planks and scantlings. This is not so, and the amount of seasoning which takes place in a log is, to all intents and purposes, negligible, in comparison with the rapid drying which can be effected with converted timber.

In addition, attempts to season wood in the log, except in a few cases, usually result in considerable loss due to surface and end cracking, longitudinal splits, fungus attack, and insect attack.

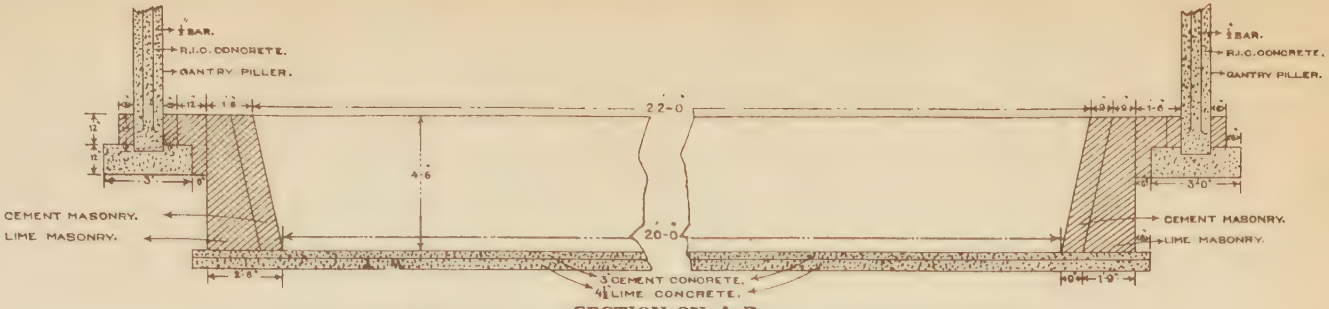
In any case, seasoning in the log is extremely slow, even under the best conditions, and experiments have shown that, even after 15 to 20 years, some species have the same amount of moisture in the centre of the log as they had when they were felled. The outside portions of such logs will probably have dried out to a certain extent, but, owing to the uneven tension set up, as the result of the inside of the log remaining wet while the outside portion is drying, surface cracking and longitudinal splitting is bound to occur. In addition, unless the species happens to be immune

from insect and fungus attack, as in the case of teak, there is almost certain to be a loss from these causes, in the sapwood at any rate.

Seasoning in the log, therefore, is for all practical purposes, useless, except in a few exceptional cases. This point is not realised by most timber users in India, and many complaints are received, as they have been greatly surprised to see that their converted timber had cracked and warped, although they had kept the logs "seasoning" for 2 or 3 years. They were also surprised when told that the wood in the centre of such logs was probably in the same condition as when the tree was felled.

So much for seasoning in the log. There are, however, occasions when it is necessary to store logs, perhaps for a year or more, before they can be converted. What, then, is the best way to keep these logs in good condition and as free as possible from cracking, splitting, and attack from insects and fungus? One of the best and most practical ways to keep logs is to store them under water. Water submersion is not a seasoning process, it is merely a method of storage. When timber is kept under water it does not dry out, but on the other hand, certain constituents of the sap such as the sugars, gums, and tannins, are leached out of the wood and replaced by water. This makes subsequent drying of the wood, after conversion, more easy, and reduces the liability to crack and split.

In addition, logs stored under water are immune from all the dangers of land storage. They cannot be attacked by borers (except *teredo*), and they are free from infection by fungi. Splitting and cracking are reduced to a minimum, and the logs are kept in good condition until required for conversion. They must, of course, be kept completely submerged, otherwise the portions exposed to the air will dry out and crack. The only real enemy to logs in under-water storage is the *teredo* borer. The danger is present only in brackish or salt water, but if *teredos* are prevalent, they can do considerable damage even to large logs. Fresh water storage is, therefore, to be preferred, and of the thousands of logs stored in the log ponds of the Forest Research Institute at Dehra Dun during the past six years, there has never been a single instance of a log having deteriorated during its period of submersion, and some have been stored under water for over two years. The value of a good log pond, therefore, cannot be over-emphasised, and with



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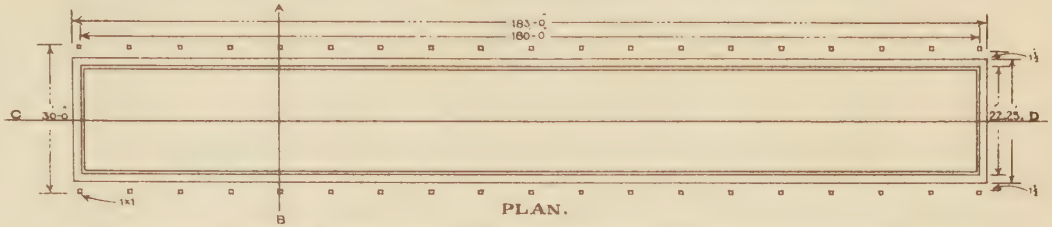
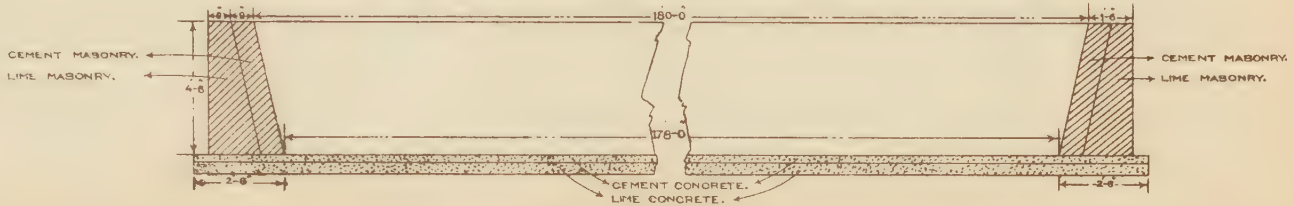


PLAN.



CROSS SECTION ON C.D.

F. R. I. Debra Dun.

Detail drawing of a log pond found suitable for Indian conditions.

No. 889

DRAWN BY.
Sultan Mohammed.

certain species, under-water storage is an absolute necessity. I have seen logs of *Terminalia tomentosa* (laurel) split so badly after a few weeks' exposure to the sun, as to render them quite useless, and it is the same with many other species. If such logs had been stored under water, they would have come to the sawmill in perfect condition.

Users of miscellaneous hardwoods in India are, therefore, strongly advised to consider the advisability of making a log storage pond if compelled, as most sawmillers are, to hold stocks of logs for any length of time. The initial expense may seem large and unnecessary, but the returns, in the saving of wood which would otherwise have to be discarded, will more than compensate them for their first expenditure.

In the event of a log pond not being available, logs should always be provided, so far as possible, with some sort of shade or shelter. They can, for instance, be stored under the shade of trees, or a covering of thatch, grass, or leaves can be spread over them. Anything, in fact, which keeps off the direct rays of the hot Indian sun is beneficial. In addition, if logs are to remain in one place for more than a few days, they should be raised off the ground to prevent damage from white ants. All bark should be removed except in the case of species which are very prone to surface cracking. The removal of bark greatly lessens the chances of the logs being attacked by insects. To prevent or retard cracking at the ends of logs, painting with waterproof paints is most beneficial, as it retards the drying out of moisture. The best paint for the purpose is hardened gloss oil, filled with lime or barytes, but white lead paint or ordinary coal tar are both useful. When none of these materials are available, an end coating of a mixture of cow-dung and mud may be applied. Incidentally, the end drying of logs is one of the chief causes of loss of timber in conversion. It is, therefore, most important that some care should be taken to protect the ends of all logs stored on land.

Green Conversion.

The above remarks refer to occasions when users have to hold logs in storage. It is very essential, however, to remember that early conversion is preferable to storage, and that the storage of

logs, even under water, is not the ideal method but only the result of necessity. Extensive experiments in air-seasoning in different parts of India have proved conclusively that the time of conversion plays an important part in the success or otherwise of the seasoning. In the case of refractory woods, it was found that conversion in the rainy season gave the best results, as drying was then retarded, and several cool months intervened before the arrival of the very hot dry weather of early summer, when drying was very rapid.

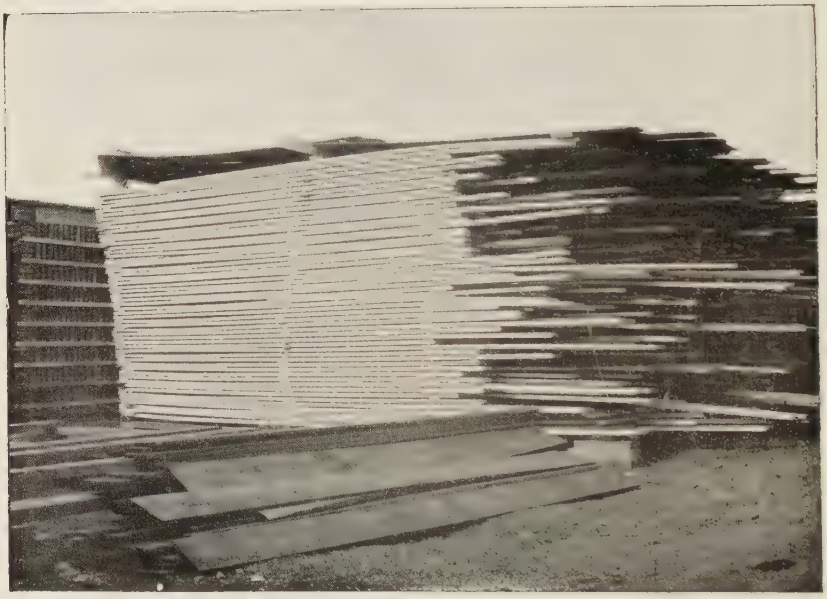
In the case of soft non-durable woods, the best results are obtained if such species are converted after the rainy season is over ; the object in this case being to dry out the timber as quickly as possible after conversion.

In this connection, a study of Indian Forest Records, Vol. IX, Part V, " Further Experiments in the Air-Seasoning of Indian Timbers and General Recommendations as to seasoning Methods " by C. V. Sweet, would be of value to all timber users. The proper season for conversion plays a far more important part in the final condition of seasoned wood than most people realise, and more attention should be paid to this very essential factor in conversion.

Photo by Dr. S. N. Kapur.

The log pond of the Weyerhaeuser Lumber Company, U. S. A. Note the log in the foreground being washed before it enters the sawmill.

F. R. I. Photograph.



F. R. I. Photograph.

Photographs of badly stacked timber. The top photograph speaks for itself, but this pile is no worse than some to be seen in timber yards in India. Note the bad alignment of the "crossers" and the long over-hanging ends of the planks in the lower photograph.

CHAPTER II.

Air-Seasoning.

By far the most important factor connected with timber utilisation in India is the proper seasoning of the woods used. This all important matter has, unfortunately, been sadly neglected in India, with the result that many excellent timbers have been condemned as liable to crack, warp, swell or shrink, while Burma teak is upheld as a pattern. The truth of the matter is that the teak had probably been standing "girdled", *i.e.*, as a dead tree, for two or three years in the forest, before it was felled, and had then taken two or more years to be floated down to Rangoon. There it was sold, and eventually found its way to Calcutta, where it was converted and afterwards stacked for six months or so, with the result that the wood, when actually used, was in a more or less seasoned state. Other species are not girdled, and are usually extracted from the forest in one year, so that, when converted, they are still quite green, and consequently crack excessively when exposed unprotected to the hot Indian sun. Teak would behave in much the same manner if similarly treated, and, as a matter of fact, green teak is no better, in this respect, than many of the lesser known woods. It is, however, a fact that the shrinkage of teak is less than the shrinkage of other timbers, and as a result, the "working" or "moving" of teak is slight. This is one of the chief reasons for its popularity. Shrinkage varies with weight, and, weight for weight, teak heads the list of Indian woods in this respect. In addition, the natural oil in teak wood retards the absorption of moisture, and, as a result, when teak is exposed to fluctuating weather conditions, it takes longer to respond to these conditions than other woods. Again, teak and most well-known Indian woods, except *sal*, are easy to air-season, whereas other timbers are not always so amenable. This drawback has militated against the latter becoming popular amongst Indian timber users. The blame, however, does not always lie with the wood, but, more often than not, it is the timber merchant himself who has not given

the wood a fair chance. The object of this Chapter is, therefore, to place before the user in simple language, a few practical directions for air-seasoning wood in India, and thereby enable him to use some of the lesser known Indian timbers, which are often far more suitable than those at present used, and at the same time cost less and give greater satisfaction.

Simple Instructions for Air-Seasoning in India.

In the main, there are two important points to be attended to in air-seasoning timber in India. These are :—

(*a*) The proper piling or stacking of the wood.

(*b*) The protection of the stack from the prevailing hot winds, the blazing Indian sun, and the rain.

(*a*) The piling or stacking of the wood.

1. The foundation upon which the pile is to be stacked is the first matter of importance to attend to. Squared logs may be used, but unless treated with some preservative, they soon rot in contact with the ground or are attacked by white ants, the infection spreading later to the pile above.

Concrete or brick-work foundations are by far the most satisfactory, being immune to fungus and insect attack, and, although slightly more expensive, are in reality the cheapest in the end, as they are permanent, and can be used again and again.

They may be put in as small pillars about 1 foot square in cross section and about 4 feet apart each way, and rising about one foot above the level of the ground. Across the top of these small pillars, squared scantlings, say $5'' \times 7''$, or any other available size, should be laid parallel to the length of the stack. These form the base upon which the timber will be stacked, and being merely a skeleton framework, allow a free circulation of air underneath the pile. On these, cross scantlings of say $3'' \times 3''$ section are placed, to serve as a base for the first line of "crossers". If the stack is to be protected from rain, the foundations should be level. If, however, the timber is to be piled in the open, then a slope of one foot in 10 should be allowed, in the direction of the length of the boards at the top of the pile, to allow rainwater to run off.

F. R. I Photograph.

F. R. I. Photograph.

Photographs showing two stacks of well piled timber. Note the well aligned crossers and the spaces left between the planks for air circulation.

The orientation of the layout of the foundation pillars is also a matter of no small importance, as on this will depend the manner in which the timber will be piled. As a general rule, and especially in the case of refractory timbers, the end of the pile of seasoning timber should face the direction of the prevailing dry winds, or, in other words, the length of the pile should be in the same direction as the prevailing winds. The main force of the hot blast is then met by the sides of the "crossers", and only the ends of the planks are exposed to it. In the case of very light soft white timbers such as *semul* (*Bombax malabaricum*), *papita* (*Sterculia campanulata*), etc., the piling should be done with the length of the crossers parallel to the direction of the prevailing winds, as quick drying is what is wanted with these timbers.

2. Having made the foundations and prepared the skeleton framework upon which the timber is to rest, nothing remains but to stack the timber which is to be seasoned. The first thing to do is to sort the planks or scantlings to their respective lengths. As a general rule, only pieces of the same length should be piled together. If, however, it is absolutely necessary to pile unequal lengths together, then the longest pieces should be sorted out and piled at the bottom of the stack, the next longest above them, and so on up the stack, with the shortest pieces at the top. Long pieces must never be piled over shorter ones, otherwise bad twisting and warping are bound to result. The ends of the bottom pieces should, as nearly as possible, be directly above the foundation pillars, and in any case should not overlap the foundation framework by more than a few inches.

The width of a pile should not ordinarily exceed 5 feet, but if it does, an open space 8" to 10" wide should be left in the middle of the pile, from top to bottom. This allows a good circulation of air in the centre of the pile and keeps the seasoning of all parts of the stack uniform. Between adjacent piles, there should be a free space of about 1½ feet to 2 feet, to allow for a free circulation of air round the pile.

3. Having sorted the pieces according to lengths, the next step is to see that sufficient "crossers" are at hand to complete the pile. To those unacquainted with correct air-seasoning practices, it must here be explained exactly what crossers are and what

function they perform. Put briefly, crossers are small battens, an inch or so square, and sufficiently long to stretch across the stack, which are placed in between the pieces of wood to be seasoned to separate them from each other and so form a small space in between the pieces, and allow the air to circulate freely throughout the stack and come in contact with practically all parts of the pieces being seasoned. If planks are piled one on top of another with nothing in between them, circulation of air would be impossible, and the surfaces of the planks lying against each other would remain damp, while other surfaces exposed to the air would be drying rapidly. This unequal drying would result in splitting, surface cracks, and warping.

It will be seen, therefore, that crossers take an active part in air-seasoning operations, and their preparation must not be neglected. They should be sawn from sound timber and should be as dry as possible. They should also be of uniform thickness, their size being approximately $1'' \times 1\frac{1}{2}''$. A width of $1\frac{1}{2}''$ in $1''$ crossers gives a more stable piling than when $1'' \times 1''$ crossers are used. Formerly it was the practice to use small crossers for thin planks and bigger crossers for larger sized stock, but taken all round, $1'' \times 1\frac{1}{2}''$ crossers are the most suitable for all ordinary work. When piling commences, the crossers are placed at intervals of not more than 4 feet, at right angles to the pieces to be seasoned. If any particular wood is very liable to twist and warp, they should be placed at lesser intervals, say 2 feet apart. The same should be done in the case of all planks of less than $1''$ in thickness, as these are more liable to bend than thicker stock. The second layer of crossers must be placed exactly above the first layer, with a layer of planks in between, and so on up the pile, so that when the ends of the crossers are seen from the side of the pile, they are all in one straight vertical line from the bottom of the pile to the top. The two end lines of crossers should always be as near the ends of the planks as possible. This prevents the ends of the planks from splitting to a certain extent, and from warping.

4. Everything now being ready, nothing remains but the actual piling of the timber, which, in itself, is not a difficult operation. Timber can, of course, be piled vertically or horizontally but these instructions deal only with horizontal piling; vertical

piling being an entirely different business, and one only used in special circumstances and not recommended as a general rule.

The piling commences, then, with a layer of the pieces to be seasoned being laid on the skeleton framework, the top of which is about 20 inches from the ground. Next above these comes a layer of crossers, at intervals, as already explained. Above the crossers, comes another layer of planks, and so on to the top of the pile. There is nothing difficult about this, the chief points to remember being to pile the longest planks at the bottom and to keep the sides, and at least one end of the planks, in a true vertical plane. If the planks are not all of one length, then the other end is bound to be irregular, the longest planks being at the bottom and the shortest ones at the top. In the same way, as already mentioned, the crossers should be in a vertical line, one above the other. It is important that adjoining planks should not actually touch each other. A small space should be left, to allow a free access of air to the sides of the planks, as well as to the top and bottom.

This then is all that is required in the proper piling of timber for seasoning. There is nothing difficult about it and it requires little, if any, more trouble than piling planks haphazard one on top of the other, a practice seen, it is sad to relate, throughout the length and breadth of India. And yet note the difference in the results. In the one case, half the stock is often lost, either through rot, staining, or white ant attack from being in contact with the ground, or from splitting, cupping, and warping. In the other case, and with very small extra expense or trouble, the timber dries out evenly and quickly, the loss due to contact with the ground is absent altogether, while cracking and warping are reduced to a minimum, and the owner has a fine stack of well-seasoned wood.

(*b*) Protection of the stack from hot winds and sun.

We now come to the second factor of importance, namely, the protection of the stack from the hot dry prevailing winds, the blazing Indian sun, and the rain; the first two being the chief causes of too rapid drying of the wood and consequent splitting and cracking. It is quite evident that a pile of timber is subjected to a terrific ordeal, if the scorching Indian sun is allowed to beat

down on it day in and day out. In the same way, the hot desiccating winds, which blow for weeks on end in most parts of India, have a drying power equal to, if not worse than, the sun.

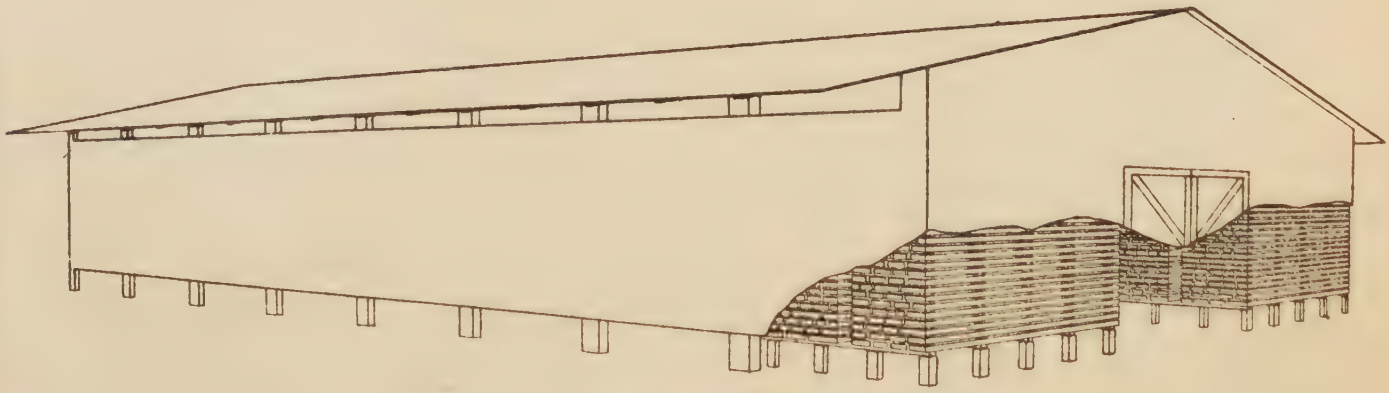
It is obvious, therefore, that some kind of protection must be given to the stacked timber, especially when dealing with woods which are very liable to cracking and splitting. The next question is to decide what kind of protection will be the best, bearing in mind that it must be effective for the class of timber to be dealt with and, at the same time, must be as cheap as possible. Mr. C. V. Sweet, late Seasoning Officer at Dehra Dun, has dealt with this question in detail in his Indian Forest Records, Vol. IX, Part V, page 65, published in 1922 by the Superintendent, Government Printing, India. He divides the Indian woods into three classes :—

(1) Woods which are very liable to crack, split, and warp, called refractory woods.

(2) Woods which are only moderately liable to crack, split, and warp, called medium refractory woods.

(3) Woods which are capable of withstanding rapid seasoning, or are particularly liable to staining, mould, and decay during seasoning, called non-refractory woods.

In order to get the best results when air-seasoning timbers falling under one of these heads, he has proposed a different type of shed for each class, and as he has put the whole matter briefly and with great clearness I cannot do better than repeat what he says. He first explains that the amount and kinds of shelter required for successful air-seasoning vary with the characteristics of the wood and the climatic conditions of the locality. Woods which have a tendency to crack and twist are those which suffer most from rapid seasoning, and therefore require means of reducing the rate of drying by maintaining a relatively high humidity in the air surrounding them. Other woods, such as *semul* (*Bombax malabaricum*) or *salai* (*Boswellia serrata*), have a tendency to discolour and decay, and must be treated quite differently from refractory woods. In this case, the surface of the wood must be permitted to dry as quickly as possible, so that fungus and mould will not be able to develop. The only protection needed in this case is from



CLASS I SHED

TYPE OF SEASONING SHED FOR REFRACTORY WOODS.

The type of construction may be that best suited to local conditions—thatch, wood, brick or bamboo and mud.

No. 889-1-2000

rain. The sun and wind should be given full opportunity to accomplish drying as quickly as possible. In the same way, woods of medium refractoriness must be given a half and half treatment, so that drying is neither too slow nor too rapid. The following are three types of sheds recommended for these three different classes of timbers :

1. *Seasoning sheds for refractory timbers.*

It is obviously impossible to lay down a rigid specification for a seasoning shed to suit all requirements, as the climate, the species to be seasoned, and the size and permanency or otherwise of the project, all have a bearing on the most suitable type of shed. However, the essentials of a suitable seasoning shed for refractory woods, especially in dry regions, are as follows :—

(*a*) A light water-tight roof to keep off the sun and rain.

(*b*) Shelter at the sides exposed to sun and drying winds.

(*c*) Ventilation under the roof and below the pile, for admitting fresh air and for getting rid of the moisture evaporated from the wood.

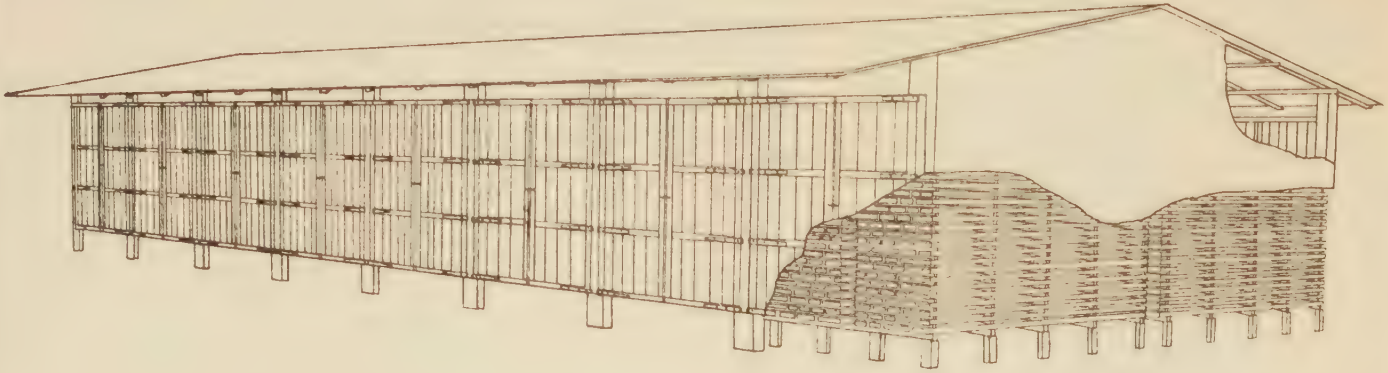
The sheds best adapted to meet the above requirements are long narrow buildings. The loading and unloading can be done either from a central passage down the middle of the shed or from the two sides. If loading from the centre is proposed, the shed should be 40 to 50 feet wide, and the timber should be piled 16 to 18 feet deep on either side of the central passage. The side walls should preferably be immoveable, and may be made of any tight material such as heavy thatch, mud, bamboo and mud plaster, wood, or brick, the essential point being that the walls must protect the timber from sun and wind and must not extend right up to the roof or right down to the ground : an opening 1½ to 2½ feet wide being left at the top as well as at the bottom, to allow a free circulation of air through the pile.

If loading from the sides is preferred, the side walls must be moveable, and the width of the shed should not be more than 30 to 40 feet. Walls consisting of a series of swinging or sliding doors

made of wood or thatch, provide a good permanent type of construction, but more temporary and cheaper walls may be made by closing the sides, except for the space under the roof and above the ground, with boards standing on end, side by side, and secured in a slot or by a collar. This arrangement involves no great expense, as the boards can be taken from discarded stock or cut from some cheap species. All or any of the boards should be easily removeable for loading or unloading, and, if necessary, a board here and there can be removed to allow a freer circulation of air if the condition of the stack requires it.

The next important thing is to know which woods are refractory and which are not. From experiments carried out by the Seasoning Section of the Forest Research Institute, the following species have been classed as refractory timbers, and timber merchants and others are advised to use sheds such as that described above, when seasoning these species :—

Aegle Marmelos (*bael*).
Anogeissus acuminata (*yon*).
Anogeissus latifolia (*bakli*).
Bassia latifolia (*mohwa*).
Bassia longifolia (*ippi*).
Careya arborea (*kumbi*).
Cassia Fistula (*amaltas*).
Chloroxylon Swietenia (satin wood).
Dichopsis elliptica (*pali*).
Diospyros Melanoxylon (*tendu*).
Eugenia operculata (*jaman*).
Grewia tiliaefolia (*dhaman*).
Hardwickia binata (*anjan*).
Lagerstræmia lanceolata (benteak).
Lagerstræmia parviflora (*nandi*).
Shorea robusta (*sal*).
Soymida febrifuga (*rohin*).
Terminalia Arjuna (arjun).
Terminalia paniculata (*kindal*).
Terminalia tomentosa (laurel).
Xylia dolabriformis (Burma pyinkado).
Xylia xylocarpa (*irul*).



CLASS II SHED

TYPE OF SEASONING SHED FOR REFRACTORY WOODS.

The type of construction may be that best suited to local conditions—thatch, wood, brick or bamboo and mud.

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2. *Seasoning shed for medium refractory timbers.*

The seasoning of woods which are only moderately liable to crack and warp can be carried out more quickly than is the case with refractory timbers. The type of shed most suitable for these timbers is practically a half section of the first shed described above, *i.e.*, one side is permanently closed (except under the roof and above ground), while the other is left open, with a roof sufficiently overhanging to protect the piles from rain. This type of shed should be left open on the north side, unless otherwise shaded, so that the exposed side will usually be in the shade. The roof, both for this type of shed and for the other type described above, may be of any material which is weatherproof, such as thatch, tiles, wood, or iron. In all cases, however, it is important that the roof should overhang the sides of the shed by at least 3 feet, so as to protect the space left for ventilation between the roof and the walls.

The following timbers may be classed as medium refractory woods and should be seasoned in sheds similar to that described above :—

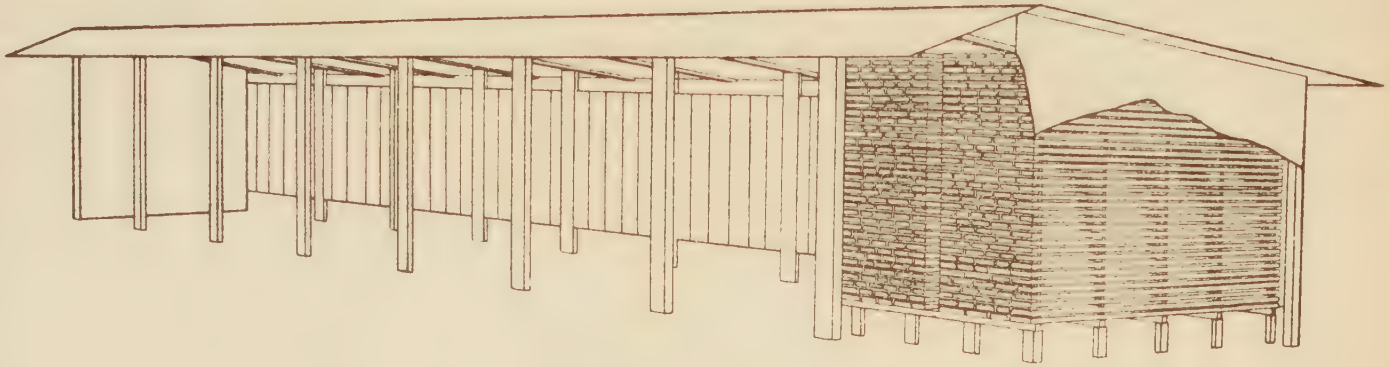
Adina cordifolia (*haldu*).
Bursera serrata (*thadi*).
Calophyllum Wightianum (poon).
Cedrela Toona (toon).
Dalbergia Sissoo (sissoo).
Dillenia pentagyna (*aggai*).
Dipterocarpus turbinatus (gurjan).
Duabanga sonneratioides (*lampati*).
Dysoxylum glandulosum (white cedar).
Eugenia Jambolana (*jaman*).
Garuga pinnata (garuga).
Hardwickia pinnata (*kolavu*).
Hopea parviflora (*irubogam*).
Hopea Wightiana (hopea).
Lagerstrœmia Flos-Reginae (*jarul*).
Melia Azedarach (neem).
Morus indica (mulberry).
Odina Wodier (*jhingan*).
Ougeinia dalbergioides (*sandan*).

Pterocarpus Marsupium (*bijasal*).
Saccopetalum tomentosum (*hoomba*).
Schima Wallichii (*chilauni*).
Stephegyne parvifolia (kaim).
Stereospermum chelonoides (*padri*).
Terminalia belerica (*bahera*).

3. *Seasoning shed for non-refractory woods.*

We now come to the last type of shed, namely, that designed for woods which are capable of withstanding rapid seasoning, or are particularly liable to staining, mould, and decay, during seasoning. The essentials in this case are almost the opposite to those for refractory woods. The chief thing is to protect the timber from rain, but at the same time to allow as free a circulation of air as possible through the pile. This is not difficult, and the type of shed required is simple. All that is necessary is that the timber should be piled under a good weatherproof roof, in such a manner that all sides are exposed to the air. It is also advisable, in this case, to place the piles so that their length is at right angles to the prevailing wind. The crossers between each layer of planks will then be end on to the prevailing wind, and the air-current can pass straight through the piles without resistance. This will result in very rapid drying of the surface of the planks, thereby preventing attack by fungi which cause rot and stain, as such fungi must have moisture to be able to establish themselves. In the case of such timbers as *semul* (*Bombax malabaricum*) and *salai* (*Boswellia serrata*) which are very liable to the rapid formation of mould and to staining, it is a good plan to stand the planks up on end against a horizontal support, for a month or so after conversion. This ensures still more rapid drying, but it should not be continued too long, otherwise the planks are apt to warp. After a month of such treatment, the planks should be piled horizontally as already described. The timbers falling under this third category are as follows :—

Acrocarpus fraxinifolius (*mundani*).
Albizzia odoratissima (black siris).
Albizzia procera (white siris).
Albizzia stipulata (*oi*).



CLASS III SHED

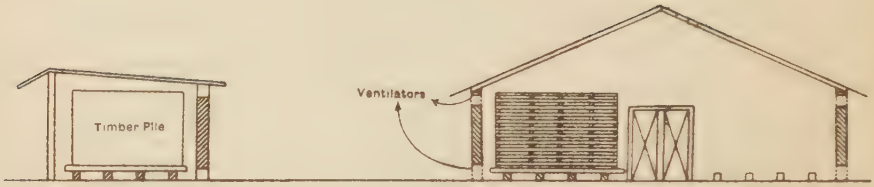
A class III shed for moderately refractory woods or for refractory woods in a damp region. This type of shed *must face the north* so that the exposed side will be protected against the sun.

No. 889-3-2000

AIR SEASONING SHED TYPE 3
SUITABLE FOR MEDIUM REFRACTORY
WOODS UNDER DAMP CLIMATE
SEASONING SECTION.
F. R. I.
DEHRA DUN.

Scale
1 2 3 4 5 10 Ft.

AIR SEASONING SHED TYPE 1
SUITABLE FOR REFRACTORY
WOODS UNDER DRY CLIMATE.
SEASONING SECTION
F. R. I.
DEHRA DUN.



SECTIONAL ELEVATION

SECTIONAL PLAN.

SECTIONAL PLAN.

Alstonia scholaris (*chatwan*).
Anthocephalus Cadamba (*kadam*).
Artocarpus Chaplasha (chaplash).
Artocarpus hirsuta (aini).
**Bombax malabaricum* (*semul*).
**Boswellia serrata* (*salai*).
Calophyllum tomentosum (poon).
Dalbergia latifolia (rosewood).
Fraxinus floribunda (Indian ash)
Gmelina arborea (*gumhar*).
Holarrhena antidysenterica (*karra*
**Holoptelea integrifolia* (*papri*).
Hymenodictyon excelsum (*bartu*).
Juglans regia (walnut).
Michelia Champaca (champak).
Pinus longifolia (chir).
Pterospermum acerifolium.
**Sterculia urens* (*katira*).
**Sterculia villosa* (*udali*).
Tectona grandis (teak).
**Tetrameles nudiflora* (*chini*).
**Trewia nudiflora* (*pitali*).
**Vateria indica* (vellapiney).

The three lists given above do not cover all Indian woods, but only those on which experiments have been carried out with a view to classifying them into their respective sections. Timber users who intend seasoning timbers other than those included in these lists, would be well advised to obtain the latest information regarding such woods from the Forest Research Institute, before they start seasoning them.

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* These timbers are very liable to stain, mould and rot.

CHAPTER III.

Kiln-Seasoning.

A few words will not be out of place to explain what is meant by the artificial seasoning of wood.

When wood dries naturally, the moisture contained in the various elements of which wood is composed, is driven off by the natural heat of the atmosphere. It is obvious, therefore, that the drying will vary considerably, being rapid when the temperature is high, and slow when the air is cool, the total period required to dry the wood down to a usable state being very prolonged, and extending even into years for large dimension stock.

Kiln-seasoning attempts to carry out exactly the same process as natural drying but in a far shorter period of time; estimated very roughly at one-twelfth of the time required to air-season the same timber.

This artificial drying of timber would thus appear to be a highly satisfactory business, but unfortunately there is a prominent drawback, and that is the ever important matter of expense. Kiln-seasoning on a small scale is expensive, owing to the large outlay of capital required to instal seasoning kilns. This is regrettable, as the utilisation of the lesser known Indian woods depends to a large extent on their use by small dealers and on their cost being considerably less than that of the better known timbers now fully occupying the popular demand. On the other hand, it should be realised that kiln-seasoning on a large scale is not expensive, and is cheaper than putting up air-seasoning sheds for the same output. A single compartment kiln, capable of seasoning 20,000 cubic feet of 1″ thick sissoo per annum, for example, could be built and equipped for about Rs. 8,000. Air-seasoning sheds for the same quantity of timber would not cost less than Rs. 12,000.

In the same way, if interest on capital locked up in stocks, and the degrade of air-seasoned stock is taken into account, the recurring expenditure is less in the case of kiln-seasoning than for air-seasoning. The chief difficulty is the output, and for economical

Photo. I. N. Sharma. March 1924.

STURTEVANT KILN.

Showing 16 varieties of Timber-Testing specimens and *Cullenia excelsa* planks stacked ready for drying.

Forest Research Institute, Dehra Dun, U. P.

working a minimum of 30,000 cubic feet of timber per annum is necessary in the case of kiln-seasoning.

The actual extra cost of kiln-seasoning depends on many factors, such as the species to be seasoned, the type and size of plant, etc. Roughly speaking, for not less than 30,000 cubic feet of 1″ sissoo planks per annum, it works out at about 8 annas per cubic foot. For two-inch stock, the figure would be Re. 1-4, and for three-inch Rs. 2-2, the cost rising very rapidly as the thickness increases and the drying period is prolonged. In a large size plant, these costs could be reduced by 40 per cent. For *toon* (*Cedrela Toona*) the costs would be about ⅔ of the above figures, and for laurel (*Terminalia tomentosa*) they would be about 1¼ times as large.

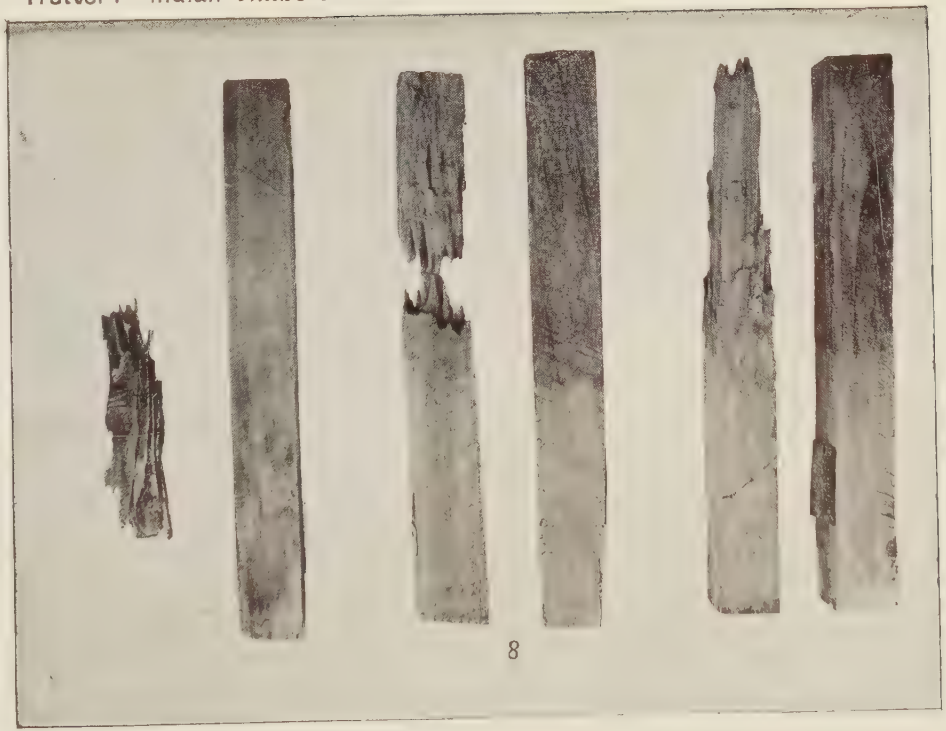
It is apparent, therefore, that kiln-seasoning is not a method of drying timber which can be used indiscriminately for all classes of timber or in all circumstances.

Put briefly, kiln-seasoning may be considered for the following undertakings :—

1. when the output of wood used is very large, say over 30,000 cubic feet of 1″ timber or a proportionately smaller amount of thicker material, per annum,
2. when the timber is very valuable, or when it is necessary to season rapidly, or where expense is of minor importance,
3. when a perishable timber is available in large quantities but cannot be used owing to its being attacked by fungus before it can be air-seasoned,
4. when dealing with very refractory woods which cannot be air-seasoned effectively. Kiln-seasoning is then the only method of making them suitable for efficient utilisation.

Under other circumstances, kiln-seasoning is not always a commercial proposition, but the Officer-in-Charge of the Seasoning Section at Dehra Dun will always be pleased to advise in cases of doubt. In the same way, if full particulars are sent, he will prepare full working schemes, together with drawings and estimates of cost, for any kiln-seasoning proposition of promise. Even small furniture manufacturers can adopt some sort of artificial drying equipment which would be economical and successful if

properly designed to suit the circumstances, but as the designs of all such plants are dependent on various factors, so is success dependent on the design, and it is always as well to get expert advice before launching out on any such schemes. In addition, kiln operators can be trained, without charge, in the kiln-seasoning laboratories at Dehra Dun, and operating charts are provided for any new undertaking, shewing the exact methods of drying to be followed for each individual timber. A letter addressed to the Forest Economist, Forest Research Institute, Dehra Dun, will always receive prompt attention.



F. R. I. Photograph.

Photograph showing the damage done to three specimens of untreated wood by white ants, as compared with three treated specimens of the same wood which were unattacked after many years.

CHAPTER IV.

The Preservation of Timber.

There are many ways of prolonging the life of wood by impregnating it with preservatives. In the main, the treatment to be given depends on whether the timber is to be used for internal work or for external work. In all cases, however, the wood must be reasonably dry, as green timber cannot be treated satisfactorily, the wood being already saturated with water. If the timber is to be used for internal work, the preservatives used must dry quickly and must not smell. There are many proprietary preservatives which fulfil these requirements, the best known of which are perhaps *Soligneum* which can be bought in various colours and which stains the wood and at the same time preserves it. Wolman Salts (Wolmanising), treatment with which is nearly colourless, and over which ordinary painting or varnishing can be done, and the Powell preservative (Powellising), which is also practically invisible. Powellised wood can also be painted or varnished.

For outdoor work, and especially for posts or struts which are to be in contact with the ground, there is no preservative which gives better results than common coal tar creosote. Creosote is manufactured in India and is obtainable in Calcutta at about Re. 1 per gallon. It can be applied with a brush, by open tank treatment, or under pressure. Brush treatment is not very satisfactory, as the application is purely superficial, and to obtain good results such treatment should be repeated at intervals and this is not always practicable. Pressure treatment can only be given in a pressure treating cylinder and need not be discussed here, but open tank treatment can be done in most places without trouble at small expense. In addition, it is quite effective, and the life of many otherwise perishable woods can be trebled by giving them a good creosote bath.

Open tank treatment consists in filling any available drum or tank with creosote and immersing the posts or pieces of wood to be treated in the creosote. The oil is then heated, either by

lighting a fire under the tank or by some other means, up to about 170° to 180°F. When this temperature is reached, the fire should be put out and the heat cut off, and the oil should be allowed to cool down, *with the wood still immersed in it.* This is the important part of the treatment, as it is during the cooling process that most creosote is absorbed by the wood. When the oil has cooled down, the treatment is complete and the wood can be taken out. The process can be repeated as often as is necessary. As suitable tanks can easily be constructed in most Indian bazaars, and as creosote is available in India at a reasonable figure, some such treatment as that described above, is well worth the small amount of extra trouble involved, when one is compelled to use perishable woods for underground work in a country like India where white ants and fungi are rampant. Any one requiring advice on the treatment of Indian woods for any specific purpose would be well advised to apply to the Forest Economist, Forest Research Institute, Dehra Dun, who will be pleased to recommend such treatment as is considered the most suitable to the occasion. In a short note of this description it is impossible to discuss the *pros* and *cons* of different treatments in detail, and, as much money can often be saved by using the proper treatment for a special purpose, expert advice should not be ignored. Such advice will be given willingly to all enquirers at Dehra Dun.

Photo. by U. S. Forest Service.

A cheap and effective method of treating the butt ends of fence posts with creosote in the forest. Two barrels filled with creosote are joined by an iron pipe and the oil is heated by a fire placed under the centre of the pipe.

CHAPTER V.

Descriptions of Common Indian Woods.

In the following pages, brief descriptions of the main features of some of the common commercial woods of India, are given. The descriptions are as short and concise as it is possible to make them, but they contain the latest information regarding weights, seasoning qualities, uses, etc.

Some critical readers may notice that some of the descriptions do not agree with the old text books on Indian timbers. This is due to the fact that the modern practices now adopted at Dehra Dun have brought to light several discrepancies in the old books. An endeavour has, therefore, been made to correct these and to give the latest and most accurate data available.

With regard to the prices quoted, it must be remembered that prices change frequently, often from month to month, and that where they are given they must be looked upon only as indications of the approximate price of the wood. No guarantee can be given that these prices will be adhered to by those who have given the quotations.

In all quotations of prices per ton, a ton has been taken as 50 cubic feet.

Abies Pindrow.

Trade name.

Himalayan silver fir.

Vernacular names.

Rai (used also for spruce), *morinda.*

Weight.

About 33 lbs. per cubic foot (air-dry).*

Description of the wood.

Silver fir is very similar in appearance to spruce, and the two timbers are often sold together as one species. The wood is white and soft and has no distinctive smell. It is an easy wood to work and finishes smoothly, but is apt to be knotty, like most Indian conifers. It is only moderately durable, but its life can be considerably prolonged if the wood is treated with a preservative. It is, however, not an easy wood to treat without incision.

Seasoning.

Silver fir can be air-seasoned without difficulty under proper conditions, but if not well seasoned the wood is liable to heart- and ray-shakes and also to fungus attack. It can be seasoned artificially without difficulty or degrade.

Strength.

The strength percentages of this timber, compared with teak, are given in Appendix I.

Uses.

Silver fir wood is a useful light "deal" timber. It is suitable for all types of light packing cases and fruit crates. It should also do well for tea chests, camp furniture, and other purposes

*NOTE.—Air-dry wood has been taken, for the purposes of this publication, as having 12 per cent. moisture content. Moisture content means the amount of moisture in wood stated as a percentage of the oven-dry weight of the wood.

where lightness is a consideration. It is often used for shingles in the Himalayas, and, if treated, is excellent for this purpose. If it grew in more accessible places, silver fir would be in much larger demand. Unfortunately it is only found in the hill forests of the Punjab, United Provinces and Kashmir and its use is, therefore, confined to the northern parts of India, the railway freight prohibiting its use in more distant parts. It is one of the few woods which would be suitable for aeroplane work, if it could be obtained in good lengths, free from knots. It makes a good treated sleeper.

Sources of supply.

The supply of silver fir wood is at present rather limited, but very large quantities are available in the forests and 30,000 tons could be extracted annually if there was a demand. It grows, however, on the higher hills, and extraction is not easy as a rule. Enquiries for this timber should be addressed to the Conservator of Forests, Utilisation Circle, Lahore, Punjab; the Conservator of Forests, Western Circle, Naini Tal, United Provinces; or the Conservator of Forests, Srinagar, Kashmir.

Prices.

Silver fir is generally brought out of the Himalayas in the form of sleepers, but logs, often in very large sizes, are obtainable at river depots in the Punjab. The present price of these logs is about Rs. 50 per ton of 50 cubic feet at depot. Silver fir B. G. sleepers are quoted at Rs. 2-8 to Rs. 4 this year (1928).

Acacia arabica

Trade name.

Babul.

Vernacular name.

Babul, kikar, gobli, joli.

Weight.

About 52 lbs. per cubic foot (air-dry).

Description of the wood.

The sapwood is white and often large. The heartwood of young trees is usually a pink colour, of the shade of old rose, but in old trees the wood is a much darker red colour and is often nearly black. The wood is very hard and durable, especially that from old trees. It finishes well and takes a good polish. It is not difficult to work or machine.

Seasoning.

Babul offers no very great difficulties so far as air-seasoning is concerned, if properly handled. It is not a bad cracker but is subject to small surface shakes. It is, however, a refractory timber, and must be dried under slow and regulated conditions, properly piled in sheds of Class I and II. The painting of the ends of this timber, when in log and scantling form, is also advised to prevent end-cracking. (See Chapter I, page 3.) From the results of a few small experiments carried out at Dehra Dun, there is every indication that it can also be kiln-seasoned without difficulty and with small degrade.

Strength.

The hardness of *babul* compared with teak is an outstanding feature of this wood. It is nearly twice as hard as teak (see column 9 in Appendix I).

Uses.

Babul wood is an extremely durable and fine timber, and deserves more recognition than is at present accorded to it. It is a very popular timber with Indian workers, who employ it extensively for agricultural implements, handles, and especially for parts of carts. It makes excellent tent-pegs, and its use by the railways for many articles where hardness and durability are required, is on the increase. The use of *babul* is recommended where these properties are required.

Sources of supply.

The tree is found throughout all the drier regions of North, Central, and South India, but it is generally scattered and good trees are not too numerous. There are, however, areas where it grows almost pure and where it can be extracted in fairly large quantities. The most important of these are in Sind. Enquiries should be addressed to the Conservator of Forests, Utilisation Circle, Lahore, Punjab. Supplies can also be obtained from the Chief Conservator of Forests, Poona, Bombay; the Chief Conservator of Forests, Naini Tal, United Provinces; and the Forest Economist, Chepauk, Madras. The Central Provinces can also supply.

Prices.

Babul is usually sold in log form, an average parcel containing logs of about 5 ft. or 6 ft. girth. Logs up to 8 ft. girth and 12 ft. length are sometimes marketted, but larger timber than this is rare. Prices vary considerably. Large logs of good quality fetch Rs. 100 per ton of 50 cubic feet, but small timber is often disposed of at about Rs. 30 to Rs. 50 per ton, and branch timber, which is often suitable for small articles, such as tool-handles and tent-pegs, is cheaper still. It is an excellent fuel, and large quantities of the smaller sizes are sold for this purpose.

Varieties.

There are several varieties of *Acacia arabica*. The two most common are the *telia* and *kauria* varieties. The wood of the *kauria* babul is reputed to be inferior to that of the *telia* babul, and the information given above refers to the *telia* variety.

Acacia Catechu.

Trade name.

Cutch.

Vernacular names.

Khair, sha (Burm.).

Weight.

Very variable. 50 lbs. to 65 lbs. per cubic foot (air-dry).

Description of the wood.

The sapwood is yellowish white. The heartwood is rather similar to that of *babul*, varying from old rose pink in young trees to a dark brown red in very old trees. The wood is very hard and durable. The hardness increases when logs are kept for some years, and the wood of very old logs is almost as hard as iron. In most logs, white specks of a powdery deposit are seen in the pores. This deposit, known as *kheersal*, is characteristic of the wood. On the longitudinal surface, these deposits often appear as thin white lines.

The wood is rather hard for working but it turns excellently. It takes a good finish and polishes finely.

Seasoning.

Cutch air-seasons easily and without fault, and, although no work has been done with this species in kiln-seasoning, there is every indication that it will kiln-season as easily and as satisfactorily as *babul*.

Strength.

No strength figures are available for this wood, but the extreme hardness of old cutch trees is well known.

Uses.

A first class wood for the handles of small tools. It is excellent for plane-bodies, mallets, chisel-handles, etc., and is used throughout

India for parts of carts, rice pestles, sugar crushers, and agricultural implements. It is extremely durable and is not attacked by white ants or fungus.

Sources of supply.

Cutch is found scattered throughout most of the drier districts of India and Burma. It is seldom found in large pure forests, but on the other hand it is a comparatively common tree in most parts. The logs are never very large and are mostly marketted in the smaller sizes required for the manufacture of cutch and *katha*, two minor forest products of no mean importance to India.

Enquiries for this timber should be addressed to the nearest Conservator of Forests, who will always inform enquirers as to the nearest source of supply. As the price usually depends on the suitability or otherwise of each log for cutch and *katha* manufacture, it is impossible to give definite information on this point. Present prices (1928) range from Rs. 3 to Rs. 10 per tree in the United Provinces. Wood with copious white deposits in the pores always commands the highest prices.

Acrocarpus fraxinifolius.

Trade name.

Mundani.

Vernacular names.

Mundani ; yetama (Burm.).

Weight.

39 lbs. per cubic foot (air-dry).

Description of the wood.

Sapwood white. Heartwood pale red or deep rose, often with darker lines. Moderately hard, but an easy wood to work. It finishes with a good surface and polishes well. If cut on the quarter, handsome mottling is often found.

Seasoning.

Mundani timber offers no difficulties when being air-seasoned or kiln-dried. The degrade in either case is negligible, except for a possibility of insect attack in the sapwood when being air-dried.

Strength.

No strength figures are available for this wood.

Uses.

Mundani unfortunately is not too plentiful. It is a sound medium-textured wood which would have a large market if the supply was larger. It might be described as an excellent "light" furniture wood. It is used for tea-boxes and furniture manufacture in the districts where it occurs. Figured quarter-cut planks should make handsome panels.

Price.

The tree only occurs in the south-west of India and in Assam, parts of Bengal and Burma. It grows to a very large size, and if

orders are placed well in advance of requirements there should be no difficulty in obtaining supplies. Enquiries should be addressed to the Forest Economist, Chepauk, Madras ; the Conservators of Forests, Assam or Bengal, or to the Conservator of Forests, Utilisation Circle, Rangoon, Burma. Prices will vary, but good logs should be obtained for about Rs. 75 per ton of 50 cubic feet f.o.r. the nearest station.

Adina cordifolia.

Trade name.

Haldu.

Vernacular names.

Haldu, hnaw (Burm.), *haddi* (S. India).

Weight.

40 lbs. per cubic foot (air-dry).

Description of the wood.

A fine close-grained timber which may be described as similar to "lustreless satin wood." It is a light yellow or straw colour when freshly cut, but it darkens slightly if left exposed. The evenness of the grain is pronounced, and this places *haldu* in the first rank of Indian turnery and carving woods. An easy wood to machine and finish, both with and across the grain. It takes polish excellently, and if properly seasoned retains its brilliance for years. If blacked and polished, it makes an excellent imitation ebony, and is very suitable for trophy or cup pedestals.

Seasoning.

Haldu offers no difficulties in seasoning either by natural or artificial means. Unseasoned, it is sometimes prone to develop fine cracks, but if well dried, it gives no cause for alarm, although, like most woods, it is susceptible to climatic changes, and allowances should be made for slight swelling and shrinking.

Strength.

Strength figures are now available for *haldu* and are given in Appendix I.

Uses.

Haldu has already established itself in India and Europe, not only as a turnery and carving wood, but as an excellent light colour

furniture and fitment timber. For such purposes as bathroom, bakery, and kitchen fitments it cannot be bettered, while its popularity for such things as toys, combs, and brushbacks is already established. It was tried for bobbins on a large scale and proved fairly successful. It would probably have done better if it had been properly seasoned, though its strength was shown to be only 80 per cent. that of beech in the case of weft pirns, and rejections were plentiful during manufacture.

Sources of supply.

Haldu is found scattered throughout the deciduous forests of India and Burma. It is not usually found in pure forests, but plantations are now on the increase. Supplies are available in most parts of India and Burma, and very large logs are obtainable, though these are sometimes fluted and hollow. This, however, does not detract from the value of the timber, except when very large planks are required. Enquiries should be addressed to the nearest Conservator of Forests. It is already very popular in the European markets.

Prices.

As with any timber found scattered throughout India, it is impossible to quote a price which covers the whole. The following quotations received this year (1928) will, however, serve as an approximate guide, though prices for this wood are liable to rise slightly owing to its popularity.

South India.—Average logs Rs. 60 per ton.

Central East India.—Average logs Rs. 60 to Rs. 75 per ton.

Burma.—Average logs Rs. 75 per ton.

Bombay.—Rs. 48 to Rs. 58 per ton f.o.r. forest stations (Northern Circle) and Rs. 60 to Rs. 100 per ton f.o.r. Bombay (from Southern Circle).

Albizzia Lebbek.

Trade name.

Kokko (sometimes known as East Indian walnut and snuff-wood).

Vernacular names.

Siris, (Hind.), *kokko* (Burm.).

Weight.

42 lbs. per cubic foot (air-dry).

Description of the wood.

The sapwood, which is often large, is greyish white in colour and of no great value from an aesthetic point of view. The heart-wood is a dark walnut brown. Some logs have a straight and mild grain; others are highly figured with dark markings. The latter produce extremely handsome panels, and not uncommonly kokko wood cuts up into planks which can compete with the finest figured timbers of commerce. The cross-banded nature of the fibres often produces an exceptionaliy fine golden-brown lustre which shows up well under polish or wax finish.

Seasoning.

Kokko stocks need careful treatment if air-seasoned. The ends of all large size stock should be coated to prevent cracking, and the ends of the stacks should be protected from hot winds. If these directions are not followed considerable loss from end splitting will result.

Kiln-seasoning, on the other hand, presents no difficulties and the degrade is negligible. Kiln-seasoned stock has also been proved more satisfactory than air-seasoned wood when recut for furniture and general use.

Strength.

This timber has not yet been tested under the routine timber testing programme at Dehra Dun.

Uses.

Kokko is a heavy wood and is too weighty for light furniture. It is, however, excellent for large heavy furniture, interior decoration, and panelling. It is strong but rather open-pored. It finishes well, nevertheless, and after grain-filling, takes an excellent polish. It is not so popular as it might be, on account of the irritation caused to the nose and throat when the wood is being sawed. This irritation is, however, only temporary and not injurious.

Sources of supply.

The largest supplies of kokko come from the Andaman Islands and Burma, but small supplies can always be obtained from other Provinces. Enquiries should be addressed to the Chief Forest Officer, Andaman Islands; the Conservator of Forests, Utilisation Circle, Rangoon: or to the nearest Conservator of Forests. Stocks of this timber are usually available from the yards of Messrs. Martin & Co., Clive Street, Calcutta, the Government Agents for Andaman timbers.

Price.

The price of squares has been fairly steady in Calcutta for the last year or two, at about Rs. 100 to Rs. 120 per ton of 50 cubic feet. It is quoted this year (1928) at Rs. 90 f.o.b. Port Blair, Andaman Islands.

There are two other *Albizzias* which are worthy of note :—

Albizzia odoratissima.

Black siris. Very similar to *kokko* but slightly heavier and harder. It occurs in similar localities but supplies are less. The price will usually be slightly below the price of *kokko*.

Albizzia procera.

White siris. Similar in appearance to the other *Albizzias* but not so heavy. It is, however, just as strong as kokko but not so hard. Obtainable all over India at moderate prices. The strength values for this wood are given in Appendix I. The weight is about 38 lbs. per cubit foot.

Altingia excelsa.

Trade name.

Not sold under any trade name at present. Will probably be known as jutili.

Vernacular name.

Jutili.

Weight.

45 lbs. per cubic foot (air-dry).

Description of the wood.

Jutili is a very hard, strong, cross-grained wood of a dull red colour. It should be converted green, as it is difficult to saw when dry. It is not an easy timber to work, owing to its hardness and cross-grained fibre.

Seasoning.

Little is known about its seasoning properties as it has not been seasoned in any quantity at Dehra Dun. It is probably one of the more refractory woods.

Strength.

No strength figures have yet been collected for this wood.

Uses.

Jutili is more suitable for sleepers and heavy construction work than for workshop stock. It makes an excellent treated sleeper, and trials in the line indicate that a treated *jutili* sleeper will remain sound for at least 12 years.

Sources of supply.

The chief supplies come from Assam. It is also found in Burma. Enquiries should be addressed to the Conservator of Forests, Shillong, Assam. The tree is fairly common in some parts of the Province.

Prices.

The price of *jutili* M. G. sleepers would probably be about Rs. 2-8 each f.o.r. the nearest station.

Anogeissus acuminata.

Trade name.

Yon (pronounced yone).

Vernacular names.

Chakwa, yon (Burm.).

Weight.

55 lbs. per cubic foot (air-dry).

Description of the wood.

The wood is creamy-grey colour and cuts with a good lustre. It is hard, straight-grained, moderately heavy, but strong and elastic. It offers no difficulties in working up, and having long straight fibres, it splits well in long lengths.

Seasoning.

Yon wood is very prone to splitting and surface cracking when being air-seasoned. In addition, special attention must be paid to the stacking of yon to prevent warping. The ends of all stacks should be protected from the prevailing winds, to minimise end-splitting and consequent loss. It is not an easy timber to kiln-season, but freshly converted stock has been dried at Dehra Dun with reasonably small depreciation. A certain amount of cracking is, however, almost certain to occur, even under the best drying conditions, and when it is to be air-seasoned, this timber should be converted during the rainy season, to reduce the inevitable surface cracking as far as possible. During the dry season, sheds must be entirely closed, to reduce ventilation to an absolute minimum.

Strength.

Special attention is drawn to the strength figures of yon, given in Appendix I. It may be noted that this timber is considerably stronger than teak under all stresses.

Uses.

Yon is a first class timber for any work where strength and elasticity are required. It should be one of the best Indian woods for such articles as hammer and tool handles, axe-helves, golf clubs, etc., and can be recommended as a substitute for ash, though rather heavier.

Sources of supply.

Burma is the chief source of supply of yon wood, and logs of kiln-seasoned stock can be obtained on application to the Conservator of Forests, Utilization Circle, Rangoon. It is fairly plentiful but is not marketted in enormous quantities. The tree also occurs in the Southern parts of Central India but not in any large quantities.

Prices.

The price of yon logs this year (1928) is roundabout Rs. 75 per ton f.o.r. Calcutta. Converted kiln-seasoned stock would probably be about Rs. 120 to Rs. 150 per ton f.o.b. Rangoon.

Anogeissus latifolia.

Trade name.

Axle-wood.

Vernacular names.

Dhaura, dhauri, bakli.

Weight.

56 to 60 lbs. per cubic foot (air-dry).

Description of wood.

The wood is a creamy-grey colour, with a small irregular purple-brown heartwood. It is an extremely hard, stiff, elastic, and tough timber. It is rather difficult to work, owing to the interlocked fibres, but with stiff tools it turns and works to a clean finish. The centre portion of large trees is often unsound.

Seasoning.

Axle-wood is another difficult timber to season, being prone to warping, end-splitting, and especially to small surface cracks. In air-seasoning, success depends, more than anything else, upon protection against too rapid drying, and conversion in hot or very dry weather should be avoided. Even in kiln-seasoning this timber is not too satisfactory, but with care the depreciation is not excessive.

Strength.

The strength figures, compared with teak, are given in Appendix I. It will be seen that this timber is considerably stronger than teak.

Uses.

Axle-wood, like yon, is an excellent timber where stiffness, combined with elasticity and toughness, is required. It is, however, a very heavy wood, but its strength qualities make it of value among Indian woods where weight is of no account, *e.g.*, for mine props, tool-handles, etc.

Sources of supply.

Anogeissus latifolia is found in most of the deciduous forests of India, but not in Burma or the Andamans. Very large logs are not available, the average running to about 5 ft. girth. It is a fairly common tree, and supplies can usually be obtained if application is made to the nearest Chief Conservator or Conservator of Forests. It is common in some Forest Divisions and rare in others close by, but an enquiry will always put the purchaser in touch with the nearest and best market.

Prices.

As with other timbers of wide distribution, it is difficult to quote accurate prices. The supply available each year and the local demand are the controlling factors, but the following figure may be taken as a rough guide: South Indian quotation, Rs. 75 per ton of 50 cubic feet f.o.r. at forest depots (1928).

Artocarpus species.

The *Artocarpus* family possesses four species of utility. These are as follows :—

Artocarpus Chaplasha.

Trade name.

Chaplash.

Vernacular names.

Chaplash ; *sam* (Ass.) ; *taungpeinne* (Burm.).

Weight.

About 34 lbs. per cubic foot (air-dry).

Description of the wood.

The wood varies a good deal in colour, some being clear yellow, while other logs cut up into light brown or even dark brown timber. It is moderately hard, easy to work and finishes cleanly. It is also often very ornamental.

Seasoning.

There is little information available as to the seasoning qualities of *chaplash* but from what there is, and if it resembles the other members of the family, it should prove amenable to both air and kiln-seasoning without degrade. Such experiments as have been carried out show it to be a non-refractory wood.

Strength.

Though *chaplash* has not yet been tested under the full routine standard testing programme, some strength figures for this species are available and can be had on application to the Forest Economist.

Uses.

Chaplash is an excellent medium weight wood, suitable for interior work and light furniture. It is also sufficiently smooth-grained to be classed as a turnery and carving wood. Also suitable for light construction, hulls of boats, etc.

Sources of supply.

The tree is found only in East India, Burma, and the Andamans; the last two having fairly large supplies. Enquiries should be addressed to the Conservator of Forests, Utilisation Circle, Rangoon; the Chief Forest Officer, Andaman Islands, or to the nearest Conservator of Forests in Assam or Bengal. Messrs. Martin & Co., Clive Street, Calcutta, often carry stocks of this timber in their store yards.

Prices.

Chaplash scantlings are quoted this year (1928) in Calcutta at Rs. 80 to Rs. 140 per ton of 50 cubic feet, according to size. Logs could probably be bought at Rs. 60 to Rs. 100 per ton according to size and quality.

Artocarpus hirsuta.

Trade name.

Aini.

Vernacular names.

Aini ; *hebalsu.*

Weight.

37 lbs. per cubic foot (air-dry).

Description of the Wood.

The sapwood is white. The heartwood is light brown or *café au lait* colour. In appearance the wood is not unlike light coloured teak, and if anything, it is easier to work, turn, finish and polish, than teak wood. It is very durable and highly resistant to white ants.

Seasoning.

Aini may be described as a model wood from the seasoning point of view. If properly looked after, it air-seasons and kiln-seasons quickly and without any difficulty or degrade.

Strength.

The strength figures of this wood, compared with teak, are given in Appendix I.

Uses.

Aini is probably the only timber in India which can be said to be equal to, if not better, for universal purposes, than teak. It is not quite so heavy as teak while its strength is little, if anything, below the strength of teak. Even the veterans in the Railway workshops admit that it ranks next in value to teak, and aini can, therefore, be recommended for all purposes as an excellent substitute for teak wood.

Sources of supply.

The chief source of supply is Madras, but the tree is also found in a lesser degree in Bengal and Burma. Unfortunately, the supplies of aini are limited, but every effort is being made to increase the output, especially in Madras. Enquiries should be addressed to the Forest Economist, Chepauk, Madras.

Prices.

Aini is quoted this year (1928) at Rs. 75 to Rs. 100 per ton in the log. Rs. 80 is probably an average price for medium quality logs. Scantlings are quoted at about Rs. 3 to Rs. 4 per cubic foot. It is probable that the price will rise as the timber becomes better known. The demand already exceeds the supply.

Artocarpus integrifolia.

Trade name.

Jack.

Vernacular names.

Kanthal; *halsu* (Kan.); *prinne* (Burm.).

Weight.

36 lbs. per cubic foot (air-dry).

Description of the wood.

When freshly cut, jack wood is a bright lemon yellow, but this tones down to a dull light brown on exposure to the air. It works, turns, and finishes well, and readily takes a good polish. It is moderately hard and durable under cover.

Seasoning.

Jack offers no difficulties in seasoning. It air-seasons quickly and with small depreciation, and will kiln-season equally easily as indicated by some small lots dried in the kilns at Dehra Dun.

Strength.

No strength figures are available for this species.

Uses.

Jack is well known to native carpenters as being an excellent cheap wood for general carpentry, plain furniture, and household work. Selected pieces can be extremely ornamental. It is also used for brush backs, inlay, and turnery, but it needs a sharp tool to bring it to a clean finish.

Sources of supply.

Jack trees are found throughout the warmer regions of India and Burma, and small supplies can usually be obtained on enquiry to the nearest Conservator of Forests. Larger parcels will probably

be available from the Forest Economist, Chepauk, Madras, and the Conservator of Forests, Southern Circle, Belgaum, Bombay.

Prices.

Current prices for jack wood in South India are quoted at Rs.75 to Rs. 100 per ton. The demand for this timber in South and West India is, however, always fairly good and prices are probably lower in other parts of India.

Artocarpus Lakoocha.

Trade name.

Lakooch.

Vernacular names.

Dhau : lakooch ; myauklok (Burm.).

Weight.

About 40 lbs. per cubic foot (air-dry).

Description of the wood.

Lakooch is very similar to jack in appearance, and handsome panels can be selected. It has a reputation for being hard to saw, but with seasoned wood at any rate this does not hold good, as the timber saws and planes easily and finishes well. It is an extremely durable timber, both exposed and under water, and is said to be immune to white ants and teredo, though no very reliable evidence is to hand in this connection.

Seasoning.

This species is very easy to season both by natural or artificial means.

Strength.

As in the case of *Artocarpus integrifolia*, no strength figures are available.

Uses.

Lakooch is an excellent medium-weight furniture wood. It can be obtained in large sizes, and is used for beams and other house-building purposes. It is prized in the Andamans for pier-piles, posts, and rafters. It is also reputed to be good for boat-building.

Sources of supply.

Enquiries for lakooch should be addressed to the Conservators of Forests, Bengal or Assam, the Conservator of Forests, Utili-

sation Circle, Rangoon, the Chief Forest Officer, Andaman Islands, or to the Chief Conservators of Bombay and Madras.

Prices.

The price of lakooch will vary in different localities, but logs should be obtainable in most places where it is found at about Rs. 50 to Rs. 100 per ton, according to quality and size.

Berrya Ammonilla.

Trade name.

Trincomalee wood.

Vernacular name.

Petwun (Burm.).

Weight.

About 64 lbs. per cubic foot (air-dry).

Description of the wood.

A very hard and heavy wood of dark reddish-brown colour. It is a handsome wood, close-grained and tough, cutting to a lustrous surface which finishes excellently.

Seasoning.

It is reported from Burma to air-season well without difficulty, while Gamble says that it is apt to split. No accurate up-to-date information is available regarding either its air-seasoning or kiln-seasoning qualities.

Strength.

No strength figures are available for this species.

Uses.

A fine timber for heavy work or hard wear and tear. It is extremely durable, and would prove satisfactory wherever great weight, strength, toughness, and durability are required. An excellent substitute for *Lignum vitae.*

Sources of supply.

The tree is a native of Burma, and enquiries for supplies of the wood should be made to the Conservator of Forests, Utilisation Circle, Rangoon.

Prices.

Logs of large girth are not available, the average being about 4 ft. to 4 ft. 6 inches. The price is usually not very high.

Bischofia javanica.

Trade name.

Bishopwood (It is sometimes called red cedar, a bad name).

Vernacular names.

Uriam (Ass.) ; *paniala* ; *kein* ; *aukkyu* (Burm.).

Weight.

35 lbs. per cubic foot (air-dry).

Description of the wood.

The wood is a dull red or reddish brown colour. It is moderately hard, but works easily and finishes to a fine surface which polishes well. Handsome panels with a wavy grain can often be picked out of a stock of this wood, but it is more a constructional than an ornamental timber.

Seasoning.

Bishopwood has a tendency to warp and crack. When air-seasoning this timber, care must be taken to protect it from too rapid drying. Kiln-seasoning, on the other hand, presents no difficulties, and timber seasoned at Dehra Dun came out of the kiln in excellent condition.

Strength.

Full strength figures are not available for this timber, but some strength data are available and can be had on application to the Forest Economist.

Uses.

Selected timber is perfectly suitable for cheap rough furniture, but the average run of this wood is dull and more suitable for structural work or sleepers. It has a reputation for being extremely durable under water and in wet places. It is recommended as a treated railway sleeper, as it treats easily and has a life in the line of about 15 years.

Sources of supply.

The chief output is from Assam, and enquiries should be addressed to the Conservator of Forests, Shillong, Assam. Smaller supplies are obtainable from Burma, Madras, the sub-Himalayan forests of the United Provinces, and from Bihar and Orissa.

Prices.

It is not an expensive wood. Burma quotes Rs. 50 to Rs. 55 per ton this year (1928), f.o.b. Rangoon. Assam usually cuts to sleeper sizes, the price being about Rs. 50 per ton.

Bombax malabaricum.

Trade name.

Semul.

Vernacular names.

Indian cotton tree ; *semul ; letpan* (Burm.).

Weight.

23 lbs. per cubic foot (air-dry).

Description of the wood.

Semul is too well known in India to need much description. The wood is usually a clean creamy white colour, very light in weight, and with large open pores. It saws and works extremely easily, but is not suitable for polishing, being too absorbent and open in texture.

Seasoning.

If air-dried, semul is apt to discolour, being very prone to fungus attack. It is also very liable to attack by borers. Kiln-seasoning, directly after conversion, prevents discolouration, and kiln-seasoned wood will keep its fresh white colour for a long time. If freshly converted planks are placed in clean water for a month or so, and are then air-dried in open stacks, good clean boards can be obtained. Vertical stacking of freshly cut stock is also advantageous. The stacking can be done in the open air. The important point to remember is to dry the timber as quickly as possible to start with.

Strength.

Semul is not a strong timber and should not be used where strength qualities are required.

Uses.

A very suitable wood for cheap light fruit crates or packing cases. Used extensively for match splints and boxes in India,

but an excess of spiral or cross-grained wood often spoils the quality of the splints. Semul is durable under water, where its chief enemies, fungi and borers, cannot attack it.

Sources of supply.

Found in practically all forests, up to 3,000 ft., throughout India and Burma. Enquiries should be addressed to the nearest Conservator of Forests.

Prices.

Semul wood is usually obtainable at cheap rates, 4 annas to 6 annas a cubic foot being the average for good logs. Scantlings are obtainable at about 9 annas to 12 annas per cubic foot in most localities.

Bombax insigne.

Didu ; found mostly in the Andamans and in Burma, is superior to semul. Its weight is 30 lbs. per cubic foot (air-dry) and, being slightly harder, it finishes better than the Indian species, and is very suitable for light kitchen furniture. It is apt to discolour if not dried soon after conversion.

Boswellia serrata.

Trade name.

Salai.

Vernacular name.

Salai.

Weight.

32 lbs. per cubic foot (air-dry).

Description of the wood.

The sapwood is usually large and of a dirty-white colour. Heartwood, light greenish-brown, sometimes with handsome markings, but except in large trees, the heartwood is too small for practical use. It presents no difficulties for sawing and working.

Seasoning.

This timber is difficult to air-season cleanly, and, unless extreme care is taken as regards the time of the year when seasoning starts, the wood will suffer considerably from decay, mould, and discolouration. Kiln-seasoning, on the other hand, prevents this deterioration, and stock, kiln-seasoned directly after conversion, comes from the kilns in a clean condition with small degrade.

Strength.

Salai should not be used where great strength qualities are required.

Uses.

The heartwood, if sufficient can be obtained, is fairly durable and often handsome, and could be used for many purposes, such as plywood panels. When speaking of this wood, however, one usually refers to the sapwood, which is neither beautiful nor durable. It is, however, perfectly suitable for cheap box work, packing and fruit crates, opium chests, and inferior grade match splints. The liability to discolouration is the chief drawback to this timber not being more extensively used.

Sources of supply.

The tree is found in most of the drier forests of India, while in Central India and especially in the Central Provinces, it is a comparatively common tree. Enquiries should be addressed to the Chief Conservator of Forests, Nagpur, Central Provinces, or to the Chief Conservators of Bombay, Madras, and the United Provinces, all of whom could probably arrange to supply smaller quantities.

Prices.

Salai is a cheap wood and logs are seldom large. Prices are bound to vary in different localities, but the timber can usually be bought at 2 annas to 4 annas per cubic foot in the forest. Bombay quotes this year (1928) Rs. 25 to Rs. 30 per ton of 50 c. ft. in the log f.o.r. forest stations.

Buxus sempervirens.

Trade name.

Boxwood.

Vernacular names.

Chikrī ; *papri.*

Weight.

About 58 lbs. per cubic foot (air-dry).

Description of the wood.

Boxwood is already too well known to need description. The Indian wood is identical with European boxwood. The species is botanically similar and the quality of the timber the same, despite the fact that some merchants maintain that Indian boxwood is inferior.

Seasoning.

Boxwood, if left lying on damp ground is liable to attack by mould. It should, therefore, be properly protected or stored in sheds. If kept in log form, it is very prone to heart and ray shakes, and logs are usually sawn longitudinally on one side from the circumference to the centre. The slit thus made can open freely, the tension on other parts of the periphery is released, and the remainder of the log is thereby kept free from shakes. Another good form of storage is in the form of "half-rounds." Box can also be dried in kilns in the form of half-wroughts without difficulty and with very little degrade.

Strength.

The uses of boxwood are not dependent on strength qualities.

Uses.

Boxwood is the finest turnery wood in the world, and no other timber of its class can compare with its close and even texture. Its chief uses are for engraving, turnery, and carving. In India, thousands of small articles are made from it, the commonest being

combs, mathematical instruments and rulers, toys, small boxes and mill rollers. For engraving it is invaluable.

Sources of supply.

Box trees are only found at high altitudes in the Himalayas and even then they are not gregarious, occurring only spasmodically where conditions are favourable to their growth. It is procurable only in fairly small sizes and small quantities. Enquiries for the timber should be addressed to the Chief Conservator of Forests, Lahore, Punjab; the Chief Conservator of Forests, Lucknow, United Provinces, and the Conservator of Forests, Utilization Circle, Srinagar, Kashmir, all of whom could probably put intending purchasers in touch with the small contractors in whose hands the sale of boxwood chiefly lies, but it must be remembered that very little of this wood is available.

Prices.

Boxwood is usually sold by weight, but as each individual parcel varies in quality and size, it is impossible to quote figures. The chief Punjab market centre for box is Amritsar.

Calophyllum species.

Trade names.

Poon (*Calophyllum tomentosum*, *Calophyllum inophyllum*, *Calophyllum elatum*, *Calophyllum Wightianum*); lalchini (*Calophyllum spectabile*).

Vernacular names.

Poon; *lalchini* (And.); *pantaga*; *wuma* (Kan.).

Weight.

41 to 48 lbs. per cubic foot (air-dry).

Description of the wood.

The wood, when freshly cut, is usually a pale browny-red, turning to a reddish-brown on exposure to the air. A prominent feature of the wood is the darker coloured bands, often seen as wavy lines on the longitudinal faces of all sawn stock. The wood saws, works, and finishes excellently. It is moderately hard and often ornamental.

Seasoning.

The Calophyllums present no difficulties in air-seasoning, if properly tended. Large planks have a tendency to split, but with ordinary care in protection and stacking, the degrade should be small. Experiments in kiln-seasoning show that these woods can be dried artificially with practically no depreciation or loss.

Strength.

Strength figures for *Calophyllum tomentosum* and *Calophyllum Wightianum* are given in Appendix I.

Uses.

Classing the Calophyllums as similar timbers, it may be said that their outstanding feature is the great size and length of the logs, and for such purposes as masts, spars, and derricks, they are

unrivalled. They are timbers worthy of the notice, not only of engineers and ship-builders, but also of all woodworking firms and furniture manufacturers, as the timber is slightly lighter than teak, easier to work and, if properly selected, extremely handsome.

Sources of supply.

Lalchini is obtainable in large sizes and fair quantities from the Chief Forest Officer, Andaman Islands, or from Messrs. Martin & Co., Clive Street, Calcutta, the Agents for Andaman timbers. The other Calophyllums, also in large sizes, can be obtained through the Forest Economist, Chepauk, Madras, where supplies are fairly large, and also from the Chief Conservator of Forests, Poona, Bombay, and the Conservator of Forests, Utilization Circle, Burma.

Prices.

Poon logs are quoted this year (1928) in South India at Rs. 70 to Rs. 90 per ton, with scantlings and sawn stock at Rs. 2-8 to Rs. 3-8 per cubic foot, f.o.r. forest railway stations.

Canarium euphyllum.

Trade name.

Dhup. Is sometimes called Indian white mahogany, an unsuitable name. White dhup is also used.

Vernacular name.

Dhup.

Weight.

About 30 lbs. per cubic foot (air-dry).

Description of the wood.

A creamy-grey or pinkish soft wood.* Very easy to work and finish to a clean surface. Not a durable wood, and one which is liable to stain if left long unseasoned after conversion.

Seasoning.

Kiln-seasons easily with practically no degrade. Should air-season without difficulty under shade.

Strength.

No strength figures are available for this species.

Uses.

Very suitable for planking, packing cases, etc. A good substitute for deal. Already well known in Europe.

Sources of supply.

Only obtainable from the Andaman Islands. Available in large quantities up to 4,000 tons *per annum* and in large sizes up to squares 40 ft. long × 30 inch sidings.

Prices.

The price quoted this year (1928) is Rs. 30 to Rs. 40 per ton f.o.b. Port Blair, for average logs. As the demand for this wood as a substitute for deal is on the increase, the price will probably rise slightly.

* "Soft wood" means a soft hardwood, and should not be confused with the word "softwood" which is usually applied only to coniferous timbers.

Cedrela Toona.

Trade name.

Toon. Sometimes known as red cedar or Moulmein cedar.

Vernacular names.

Toon; *thitkado* (Burm).

Weight.

30 lbs. per cubic foot (air-dry).

Description of the wood.

The wood is a pinkish brick-red when freshly cut, toning to a light brownish-red on exposure. An easy timber to saw, work, and finish and, if properly filled, taking a high polish. It expands and contracts with variations of the atmosphere, and allowances have to be made for this not uncommon feature in an Indian climate.

Seasoning.

An easy timber to deal with, both in air-seasoning and kiln-seasoning. It seasons quickly and does not warp, split, or crack, under proper treatment.

Strength.

Strength figures for toon are available, as also are the strength figures for *Cedrela serrata*, a very similar species of the same family. They will be found in Appendix I.

Uses.

Toon is probably the most commonly used "bazaar" furniture wood in India. Being cheap, light, easy to work and quickly seasoned, it lends itself for use in small workshops. It cannot, however, be called a handsome timber, as it tones down to a dull uniform colour, devoid of character. Besides furniture, it is used for many common household articles and for tea-boxes, cigar-boxes, toys, and carving.

Sources of supply.

Toon is obtainable from practically all the lower forests of India and Burma and is extensively planted along roads. It is usually obtainable from the nearest bazaar or timber merchant. Larger supplies could be had on application to the nearest Divisional Forest Officer.

Prices.

Prices are bound to vary throughout India for such a universal species, but the wood should usually be available in the log at Rs. 40 to Rs. 80 per ton of 50 cubic feet, according to size and quality.

Cedrus Deodara.

Trade name.

Deodar. Sometimes called Himalayan cedar.

Vernacular names.

Deodar; *paludar*; *nakhtar.*

Weight.

35 lbs. per cubic foot (air-dry).

Description of the wood.

Deodar needs no description in India. Its light yellow-brown colour and distinctive odour are well known to all timber merchants. It is a light to medium-weight wood, extremely easy to saw, work, turn and finish. The continuous oozing of resin from the knots, however, does not favour its use where ornamentation or polished work is intended.

Seasoning.

An easy wood to air-season under ordinary conditions. In kiln-seasoning also *deodar* gives no trouble, and it comes from the kilns with negligible degrade.

Strength.

The strength figures of *deodar*, compared with teak, are given in Appendix I.

Uses.

The primary use of *deodar* at present is for sleepers, as it is extremely durable, and the heartwood is reasonably immune to white-ant attack. It is, however, really too good a wood for such purpose. It is in fact more suitable for bridge-construction, house-building, beams, floor boards, shingles, light unpolished furniture, etc., and has proved to be an excellent wood for pattern making.

Sources of supply.

Enquiries for *deodar* should be addressed to the Conservator of Forests, Utilization Circle, Lahore, Punjab ; the Chief Conservator of Forests, Lucknow, United Provinces, and to the Conservator of Forests, Srinagar, Kashmir. The largest supplies come from Kashmir.

Prices.

Usually extracted in sleeper sizes, but logs up to very large dimensions can be purchased at the Punjab river depots. First class B. G. sleepers are quoted this year (1928) at about Rs. 7-8-0 each, but good sleepers can usually be purchased at half this price in the Punjab depots and bazaars. Logs are quoted at Rs. 75 to Rs. 100 per ton at Jhelum. The price is slightly on the decline at present, due probably to the best and biggest trees in the forests having been extracted.

Cupressus torulosa.

Himalayan cypress. Very similar to, but whiter than *deodar*, and can be used for all purposes for which *deodar* is used. If anything, cypress timber is slightly superior to *deodar*, especially for interior work. It is certainly just as durable, if not more so, and is very easy to work. Unfortunately supplies are limited. Enquiries should be addressed as for *deodar*, but large parcels must not be expected. The price is usually about the same or a little lower than that of *deodar*.

Chloroxylon Swietenia.

Trade name.

Satinwood. East Indian satinwood (European market).

Vernacular names.

Behra ; *bhira* ; *bhiri.*

Weight.

56 lbs. per cubic foot (air-dry).

Description of the wood.

Satinwood is a hard creamy-yellow or golden-yellow wood with a fine satiny lustre, often highly figured with roe, mottle, and silver-grain. Rather cross-grained for clean sawing and working, but it turns and finishes to a fine surface with sharp tools, and retains its lustre indefinitely.

Seasoning.

In air-seasoning, special care must be given to this wood, to prevent too rapid drying, which results in hair cracks appearing on the surface. With good end protection and slow drying this defect is avoided. In the same way, when kiln-seasoning, the process must be slow, and if care is given, the timber dries well with small degrade. It has a tendency to warp if not well dried.

Strength.

This timber has not yet been tested under the routine timber testing programme at Dehra Dun, and no figures of strength are, therefore, available.

Uses.

A highly ornamental timber for fancy wood-work, bandings, framings, cabinet-making, panelling, brush-backs, and mathematical instruments. A first class veneer wood, and one in which the variety of figuring can be utilised to great effect.

Sources of supply.

Enquiries for satinwood should be addressed to the Forest Economist, Chepauk, Madras; the Chief Conservator of Forests, Nagpur, Central Provinces, and the Chief Conservator of Forests, Poona, Bombay. Large quantities of small size logs are obtainable.

The tree does not occur to any large extent in other parts of India. The chief source of supply for the European market is Ceylon, where the tree is more common than it is in India.

Prices.

Prices vary considerably with the supply and demand. As much as Rs. 100 per ton is sometimes paid for good logs, while at other times buyers cannot be found at Rs. 40 per ton. An average price is probably about Rs. 70 per ton, with well figured wood at a higher level.

Cullenia excelsa.

Trade name.

Karani (wild durian).

Vernacular name.

Karani.

Weight.

39 lbs. per cubic foot (air-dry).

Description of the wood.

The wood is a pale reddish-brown. It is moderately hard, but works easily to a fair finish.

Seasoning.

Kiln-seasons readily, but rather apt to split when air-seasoning. It is very liable to stain and fungus attack, if not dried soon after conversion.

Strength.

The strength figures are given in Appendix I.

Uses.

A useful cheap wood for planking, packing cases, crates, etc. Its durability could be greatly improved with preservative treatment.

Sources of supply.

Karani is only found in South India. It is obtainable in fair quantities and often in large sizes. Enquiries should be addressed to the Forest Economist, Chepauk, Madras.

Prices.

The price quoted this year (1928) in South India is Rs. 63 per ton in the log, f.o.r. at forest stations.

Dalbergia species.

The *Dalbergia* family contains some of India's finest timbers. The best known are *Dalbergia latifolia* (blackwood); *Dalbergia Sissoo* (sissoo); *Dalbergia cultrata* (*yindaik*) and *Dalbergia Oliveri* (*tamalan*).

Dalbergia latifolia.

Trade name.

Bombay blackwood or Indian rosewood. Often called *shisham* in Bombay Presidency. This is a confusing name as *Dalbergia Sissoo* is known as *shisham* in North India.

Weight.

Weight 55 lbs. per cubic foot (air-dry).

Description of the wood.

An extremely handsome furniture wood. Rose-purple when freshly cut, toning to dark brown on exposure. Probably the finest furniture wood India possesses. Very strong and easy to work. Already well known in European markets.

Sources of supply.

Obtainable in large sizes on enquiry to the Forest Economist, Chepauk, Madras, or the Chief Conservator of Forests, Poona, Bombay. About 2,000 tons per annum is the estimated output.

Strength.

The strength figures for blackwood are given in Appendix I.

Seasoning.

Blackwood can be air-seasoned and kiln-seasoned without trouble and with little degrade.

Prices.

The price of blackwood in the log is at present (1928) about Rs. 100 to Rs. 200 per ton according to size and quality. Bombay have quoted Rs. 130 to Rs. 137 per ton in the log f.o.r. Bombay.

Dalbergia Sissoo.

Trade name.

Sissoo (often called shisham). Weight 50 lbs. per cubic foot.

Description of the wood.

The heartwood varies from golden-brown to dark-brown. Very similar to blackwood, but without the purple colour of the latter. A very handsome furniture wood, often with extremely fine grain. Very strong, elastic, and usually easy to work. If interlocked fibre is present, it is sometimes difficult to work sissoo to a clean surface. Extremely suitable for chairs, wheel spokes and felloes, sporting requisites, and turnery. Cut on a rotary lathe it yields very handsome panels of broad wavy figure.

Sources of supply.

Obtainable in practically every bazaar in North and East India, but in much smaller sizes than blackwood. Large trees are usually hollow and full of defects. Local demand accounts for most of the sissoo timber extracted, but it can usually be purchased in bazaars in log, scantling, or plank form.

Strength.

The strength figures for sissoo are given in Appendix I.

Seasoning.

Sissoo can be air-seasoned and kiln-seasoned without trouble. The degrade is usually small.

Prices.

The price of United Provinces first class selected logs is about Rs. 125 per ton this year (1928). Average logs are usually available at Rs. 50 to Rs. 100 per ton.

Dalbergia cultrata.

Trade name.

Yindaik ; (sometimes called Burmese ebony).

Description of the wood.

A very handsome dark-brown purple, and sometimes almost black, wood. Fairly hard, but seasons, works, turns, and polishes without fault. An excellent timber for carving and turnery, and for small ornamental articles, such as walking sticks, handles, etc., and for high class cabinet work and inlay.

Sources of supply.

Obtainable in moderate size logs, and in small quantities only, through the Conservator of Forests, Utilisation Circle, Rangoon, Burma. The price varies with the quality of the logs available.

Dalbergia Oliveri.

Trade name.

Tamalan.

Description of the wood.

Another excellent wood for high class cabinet work, turnery, and carving. Colour varying from old-rose and scarlet to dark purple-brown. One of India's most beautiful timbers. Hard and close-grained, but easy to work, turn, finish and polish to a brilliant surface. Stock with fine wavy grain can be cut into extremely ornamental panels.

Sources of supply.

Obtainable on application to the Conservator of Forests, Utilisation Circle, Rangoon, Burma, in small quantities. The price will vary according to the quality of logs available.

Diospyros species.

The term ebony is applied to many woods which are black, hard, and close-textured. India possesses several such woods, the best known of which are the following :—

Diospyros Ebenum.

True ebony. A rather rare tree, occurring only in the West and South West of India. The heartwood is usually true black. Small quantities only are available, and enquiries should be addressed to the Chief Conservator of Forests, Poona, Bombay, or the Forest Economist, Chepauk, Madras. The price is high, usually at about Rs. 6 to Rs. 8 per cubic foot. The sapwood is yellow-grey and in some trees the black heartwood is very small, so purchasers should specify "heartwood only" if they want the true ebony.

Diospyros Melanoxylon.

Tendu; the false ebony. Weight about 51 lbs. per cubic foot (air-seasoned). A fairly common tree of central India. The heartwood is seldom true black, but is usually a very dark green or dark brown with black streaks. Wood hard, rather brittle, and somewhat difficult to season and work. It is used as a substitute for true ebony, and is obtainable on application to the Chief Conservators of Forests, Nagpur, Central Provinces; Poona, Bombay; and Lucknow, United Provinces.

The sapwood, which is a pale greyish colour, is used extensively for tool handles, shafts, etc. It is very tough and elastic and easy to season, whereas the heartwood, which is very hard, is apt to split and develop surface cracks. Strength figures for this species are given in Appendix I.

Diospyros oocarpa (Syn. D. Kurzii).

Trade name.

Andaman marble wood or zebra wood. The scientific name is under verification.

Description of the wood.

As the names imply, the true black centre of this timber is striped with irregular pale light-brown or cream-coloured bands, resulting in a bizarre bi-coloured effect. For certain articles, such as walking-sticks, small panels, and fancy work, this characteristic can be used to great advantage and with pleasing effect.

Sources of supply.

The wood is obtainable in small quantities only from the Andamans, and commands a high price; Rs. 300 per ton in the log f.o.b. Port Blair being about the average. Enquiries should be addressed to the Chief Forest Officer, Port Blair, Andaman Islands, or to Messrs. Martin & Co., Clive Street, Calcutta, the Government Agents for Andaman timbers.

Dipterocarpus species.

This family contains several commercial timbers of value, which can be obtained in very large quantities. The best known are *Dipterocarpus tuberculatus* (eng. or in); *Dipterocarpus turbinatus* gurjan or *kanyin* (Burm.), with which can be grouped *Dipterocarpus indicus*, *Dipterocarpus alatus*, *Dipterocarpus obtusifolius*, *Dipterocarpus Griffithii* and *Dipterocarpus pilosus* (hollong), all of which pass under the name of gurjan in the Indian and European markets.

Dipterocarpus tuberculatus.

Trade name.

Eng. or in, sometimes known as eng-teak, *yang*, and *maiyang*, the last two being Siamese names.

Weight.

Weight about 53 lbs. per cubic foot (air-seasoned).

Description of the wood.

A very large and common tree which grows only in Burma. The timber, which is obtainable in very large quantities, is a light brownish-red, hard, but easy to work and finish. It darkens on exposure, but has no figure. With ordinary care, it seasons easily and is recommended as a "utility" timber of proved reliability. It is already well known in European markets, where it is sold readily for building purposes, construction, boat-building, railway-carriage work, and utility furniture.

Prices.

The price is approximately Rs. 85 per ton (1928) for large squares in Calcutta, and enquiries should be addressed to Messrs. Martin & Co., Clive Street, Calcutta, or to the Conservator of Forests, Utilisation Circle, Rangoon, Burma. It is one of Burma's foremost utility woods. Strength figures are given in Appendix I.

Dipterocarpus turbinatus and allied timbers.

Trade name.

Gurjan. Known as *kanyin* in Burma, and often sold as *maiyang*, the Siamese name for eng.

Weight.

Weight about 48 lbs. per cubic foot (air-seasoned).

Description of the wood.

The gurjans are common trees in Burma, the Andaman Islands, Madras, and Assam (*Dipterocarpus pilosus*).

The wood is not unlike eng. It is rather rougher to work, but is almost as strong. They are all very suitable timbers for construction work, house-building, flooring, roofing, and utility furniture. Gurjan has been found especially good for parquetting, and the Bank of England, London, and other important offices have been floored with this wood, which is reputed to be silent to the tread.

Prices.

Obtainable in large quantities and in big squares, especially from Burma and the Andamans. The price is moderate, usually at about Rs. 85 per ton in Calcutta and Rs. 100 per ton in South India. In Burma, it can be bought at Rs. 75 per ton, for good quality logs or squares.

Seasoning.

The gurjans air-season quickly and easily and give little trouble. Kiln seasoning is protracted and not very satisfactory. The most economical way to deal with these timbers would be to air-season them first and then to finish off the drying in kilns.

Sources of supply.

Enquiries for Burma gurjan should be addressed to the Conservator of Forests, Utilisation Circle, Rangoon, Burma; for

Burma and Andaman gurjan, to Messrs. Martin & Co., Clive Street, Calcutta ; for South Indian gurjan to the Forest Economist, Chepauk, Madras ; and for hollong to the Conservator of Forests, Shillong, Assam.

Strength.

Strength figures for *Dipterocarpus alatus*, *Dipterocarpus pilosus*, *Dipterocarpus tuberculatus* and *Dipterocarpus turbinatus* are given in Appendix I. *Dipterocarpus pilosus* has a weight of 45 lbs. per cubic foot (air-seasoned), and for some purposes makes a good substitute for imported ash.

Grewia tiliaefolia.

Trade name.

Dhaman.

Vernacular names.

Dhamin ; *pharsa* ; *dhaman.*

Weight.

47 lbs. per cubic foot (air-dry).

Description of the wood.

Sapwood white. Heartwood light reddish-brown, hard, very close-grained, elastic and tough. An easy timber to saw, machine, and finish, and a first class wood for turnery work.

Seasoning.

This species comes under the heading of refractory woods, and the timber must be protected from too rapid drying. Logs should be converted during the rains. Most stock air-seasons quickly and without much degrade, but occasionally surface cracking and cupping is troublesome, especially in wood cut from near the centre of the tree. Kiln-seasoning presents no great difficulties, the timber coming out clean and without blemish, so long as the original timber is sound, and the kiln seasoning process is slow.

Strength.

This species has been subjected to the full routine tests, at Dehra Dun, and its strength figures can be seen in Appendix I.

Uses.

An excellent timber where strength, elasticity, and toughness are required, *e.g.*, for shafts, tool handles, axe-helves, golf clubs, etc. Probably one of the best woods in India for picking-arms, bobbins and high class turnery work. As a beam it is very considerably stronger than teak.

Sources of supply.

Dhaman grows in most of the Sub-Himalayan forests, and throughout Central and South India. Enquiries should be addressed to the Forest Economist, Chepauk, Madras, or to the Chief Conservators of Forests, United Provinces, Bombay, and Central Provinces.

Prices.

Dhaman is quoted this year (1928) in South India at Rs. 50 to Rs. 60 per ton in logs, f.o.r. forest depots.

Gluta species.

This family contains two of India's most handsome furniture and cabinet woods, namely, *Gluta tavoyana* (*chay*) from Burma and *Gluta travancorica* (gluta) from South India. Unfortunately, supplies of both are small.

Trade name.

Gluta.

Vernacular names.

Chay (Burm.); *shencurungi* (South India).

Weight.

52 lbs. per cubic foot (air-dry).

Description of the wood.

The heartwood is a rich red colour, often well marked with darker coloured grain. Not unlike Andaman padauk, but retaining its red colour even when exposed. They are both hard timbers but they work and finish easily and with a very clean surface.

Seasoning.

Both species are somewhat refractory but they air-season without much trouble or degrade. Small lots, kiln-seasoned at Dehra Dun, indicate that both timbers are amenable to artificial drying, without trouble or degrade.

Strength.

This timber has not been tested for strength as yet at Dehra Dun.

Uses.

Both timbers rank high among India's cabinet woods, and are eminently suitable for all kinds of high class furniture, or turnery.

Sources of supply.

Chay is obtainable only from Burma, and enquiries should be addressed to the Conservator of Forests, Utilisation Circle, Rangoon. The South Indian wood is obtainable in very large sizes and the Forest Economist, Chepauk, Madras, will be pleased to put intending purchasers in touch with suppliers. Supplies from both sources are limited.

Prices.

Prices will vary in accordance with supplies. No recent quotations are available.

Gmelina arborea.

Trade name.

Gumhar.

Vernacular names.

Gumhar ; *gumbar* (Beng.) ; *yemane* (Burm.).

Weight.

About 30 lbs. per cubic foot (air-dry).

Description of the wood.

Usually pale yellowish or reddish-brown in colour. Close-grained and working easily to a fine finish. Often finely marked with roe and mottle.

Seasoning.

An extremely easy wood to air-season and may be described as a model wood in this respect, stock usually drying out in faultless condition. It behaves similarly in kilns, and dries quickly without degrade of any sort.

Strength.

Full strength figures are not available for this timber, but some strength data have been collected and can be had on application to the Forest Economist.

Uses.

Although gumhar cannot rank with such woods as blackwood and padauk, it is, nevertheless, an extremely useful, and often handsome, wood. Being durable, and especially so under water, and having a low shrinkage figure, it is most suitable for boat building, musical instruments, picture frames, door framing, panelling, etc., in addition to being an excellent wood for furniture, tea boxes, and generally utility work. It has been proved excellent for pit-props, and might make a good pattern wood, due to its low shrinkage figure.

Sources of supply.

Found in most plains forests of India and Burma. The chief supplies come from Burma, Bengal, Assam and Chittagong. Enquiries should be addressed to the Conservator of Forests, Utilisation Circle, Rangoon, or to the nearest Divisional Forest Officer or Conservator of Forests.

Prices.

Gumhar is quoted this year (1928) at Ballarshah Depot, Central Provinces, at Rs. 50 to Rs. 75 per ton in the log. Squares were sold at Rs. 80 to Rs. 90 per ton.

Hardwickia pinnata.

Trade name.

Has been called satinee and piney in home markets, but both are unsuitable names. Piney is the official trade name at present. It is sometimes known as Malabar mahogany.

Vernacular names.

Kolavu.

Weight.

About 43 lbs. per cubic foot (air-dry).

Description of the wood.

Sapwood large and whitish; heartwood dark brick-red, and often exuding a sticky resin. Works easily, but not suitable for polished work on account of its resin.

Seasoning.

This wood air-seasons without trouble or degrade, although the sapwood is liable to decay and insect attack. It has not been kiln-seasoned as yet but should give no trouble in this respect.

Strength.

No strength figures are available for this timber.

Uses.

An excellent wood for rough construction work, and one recommended in South India for building purposes, beams, rafters, and similar work.

Sources of supply.

Available in large quantities from Madras, and especially from the forests of Coorg. Enquiries should be made to the Forest Economist, Chepauk, Madras.

Prices.

Prices for the wood are usually not high. No recent quotations are available.

Hardwickia binata.

Anjan. An extremely heavy, hard, and durable wood. Heartwood dark red-brown. The timber works fairly easily, despite its hardness and cross grain. It turns to a good finish with a hard tool. Its weight is 65 lbs. per cubic foot (air-dry) which is 62 per cent heavier than the weight of teak. An excellent timber where great hardness, weight, and toughness are required. It is used extensively for machine bearings, naves of wheels, agricultural implements, and for constructional posts and beams. It should be excellent for paving blocks and floorings.

Full strength figures are not available for this species, but some strength tests have been carried out, and such figures as are available can be had on application to the Forest Economist.

Heritiera minor.

Trade name.

Sundri.

Vernacular names.

Sundri ; *kanazo* (Burm.).

Weight.

65 lbs. per cubic foot (air-dry).

Description of the wood.

Sapwood pinkish-grey ; heartwood dark reddish-brown. A very hard, heavy, close-grained, strong, tough, elastic, and durable wood. Works well to a good finish. A wood that can be recommended where the qualities mentioned above are required.

Seasoning.

The seasoning of this species must be done slowly as the wood is very prone to surface cracking. With care, the degrade should be small.

Strength.

Certain strength figures are available for this timber. These can be obtained from Dehra Dun, but it has not as yet been fully tested under the routine timber testing programme.

Uses.

The great strength, toughness, and elasticity of sundri render it one of India's most valuable timbers. For beams, posts, pit-props, boat-building and similar work it is ideal, and can be used in smaller sections than most timbers, owing to its great strength. It is a heavy wood, but here again, smaller sizes can be used, thereby making it suitable for such articles as axe-helves, tool-handles, and golf club shafts.

Sources of supply.

Sundri is available in large quantities in Calcutta and Burma. It is a mangrove swamp tree, and supplies are always available if orders are placed in good time. Calcutta timber merchants usually carry stocks of this wood. Enquiries should be addressed to the Conservator of Forests, Southern Circle, Bengal, or to the Conservator of Forests, Utilization Circle, Rangoon, Burma.

Prices.

The price of sundri is at present (1928) about Rs. 55 to Rs. 60 per ton f.o.b. Rangoon. In Calcutta prices vary considerably, owing to the very large local demand for boat-building and house construction. Much larger logs can be obtained from Burma than from the Bengal forests.

Hopea species.

The *Hopea* family includes several useful commercial timbers, of which *Hopea odorata* and *Hopea parviflora* are the best known. A timber very closely allied to these is *Balanocarpus utilis*, and for commercial purposes it may be taken as identical with *Hopea parviflora*.

Hopea odorata.

Thingan. Heartwood yellowish-brown, darkening on exposure. Straight-grained, strong, and elastic.

Weight 47 lbs. per cubic foot (air-dry).

Works fairly easily to a fine finish. Air-seasons under ordinary conditions with little trouble or degrade but is sometimes liable to develop surface cracks. Kiln-seasons without trouble or depreciation. Owing to its great strength, elasticity, and toughness, it is a timber which can be recommended for such work as requires these qualities, *e.g.*, bridge-construction, carriage-building, tool handles, golf club shafts, etc. It turns well to a clean finish with a sharp tool, and, in addition, is extremely durable even under ground. Obtainable on application to the Conservator of Forests, Utilisation Circle, Rangoon, or to the Chief Forest Officer, Andaman Islands.

The price of this wood in Rangoon is quoted this year (1928) at approximately Rs. 175 per ton, and is not likely to come down, as the quality of the wood is becoming well known and the demand is likely to increase rather than diminish.

Strength figures for this timber are given in Appendix I.

Hopea parviflora.

Irubogam; *kongu.* Very similar in appearance to thingan. It is, however, a good deal heavier than that timber, weighing 58 lbs. per cubic foot (air-dry). Very strong, elastic, tough, and durable. It is much prized locally for house-building, bridge-construction, boat-building, and similar work, for which its strength and durability render it eminently suitable. It air-seasons with little trouble and, if well stacked and protected, dries quickly with negligible depreciation. Like thingan, it is a wood which can be

recommended where strength qualities are required, but its weight is against it where lightness is a consideration. Enquiries should be addressed to the Forest Economist, Chepauk, Madras.

Prices quoted in South India this year run at about Rs. 85 to Rs. 100 per ton in the log. The West Coast quotes higher at Rs. 150 per ton.

Strength figures for this timber are given in Appendix I. It will be noted that in every case the figures for this wood are very much higher than those for teak.

Juglans regia.

Trade name.

Walnut.

Vernacular names.

Charmaghz; *akhor* (Kashmir); *akhrot.*

Weight.

33 to 35 lbs. per cubic foot (air-dry).

Description of the wood.

The close-grained greyish-brown wood of walnut, often beautifully mottled, requires little description. Indian walnut varies considerably in colour, some being a dull grey, while other wood may be dark brown. It is not, however, the colour alone which has made walnut wood of such value. It is a relatively light wood, of extreme toughness, hardness, and elasticity, working easily and finishing to a fine surface. Its most important quality, however, rests in the fact that, when once dried, it is not liable to shrink, swell, or split excessively when exposed to damp, wet or heat. This, combined with its lightness and strength, gives it pre-eminence amongst the timbers of the world as the best gun and rifle stock wood yet found.

Seasoning.

Walnut wood seasons slowly and shrinks considerably while doing so, but, except for this, it air-seasons and kiln-seasons with little trouble, and under ordinary air-seasoning conditions usually comes out free from seasoning defects, although large planks are rather liable to split down the middle.

Strength.

Walnut has not yet been tested at Dehra Dun under the full routine tests. Certain strength figures for Indian walnut are, however, available and can be had on application to the Forest Economist.

Uses.

Practically the whole supply of Indian walnut is taken up by the Government Rifle Factories, as, so far, no common substitute has been found to take its place for the wooden parts of rifles. It is an excellent wood for carving and is much used for this purpose in Kashmir, in addition to being a valuable furniture wood. It peels easily on a rotary veneer machine and gives plywood panels of value.

Sources of supply.

Available supplies are not large, but Kashmir can supply a certain amount of walnut wood annually. Enquiries should be made to the Conservator of Forests, Utilisation Circle, Srinagar, Kashmir. Small supplies can also be obtained from the Punjab and the United Provinces. Enquiries should be addressed to the Conservator of Forests, Utilisation Circle, Lahore, Punjab, or to the Conservator of Forests, Western Circle, Naini Tal, United Provinces.

Prices.

Prices vary considerably in different localities, and intending purchasers should make enquiries before placing orders.

Burrs.

Walnut burrs command a high price for veneer work. Unfortunately they are now scarce in India and only small quantities can be produced.

Black Walnut.

The wood known as black walnut is the product of the American species *Juglans nigra*. It is very similar in character to the European walnut, but is usually darker and more handsome. It is the chief wood used for shotgun stocks and expensive walnut furniture.

Lagerstroemia species.

This family comprises many well known and useful woods. The chief of these are *Lagerstroemia Flos-Reginae* (*jarul*); *Lagerstroemia hypoleuca* (Andaman *pyinma*); *Lagerstroemia lanceolata* (benteak); *Lagerstroemia parviflora* (*nandi*) and *Lagerstroemia tomentosa* (*leza*).

Lagerstroemia Flos-Reginae.

Jarul; *ajhar* (Assam); *pyinma* (Burma).

A fairly common tree, found chiefly in Assam, Burma, and near the West Coast of India. Heartwood pale red, dulling off on exposure. Hard, durable, elastic, straight-grained, and working to a clean finish. Weight 40 lbs. per cubic foot (air-dry). A good timber and one recommended for house-building, constructional work, furniture, boat-building and other general uses. It is reputed to be one of the most durable Indian woods under water. Obtainable in fairly large quantities through the Conservator of Forests, Shillong, Assam; or through the Conservator of Forests, Utilisation Circle, Rangoon, and through the Forest Economist, Chepauk, Madras.

The strength figures for this timber are given in Appendix I.

Lagerstroemia hypoleuca.

Andaman pyinma. Sometimes sold as "kutcha teak." Similar to jarul in appearance but heavier and stronger. It is usually very straight-grained. Weight 53 lbs. per cubic foot (air-dry). An easy timber to work to a clean finish, and one which seasons well both naturally and artificially. Being strong and elastic it has proved excellent for sporting requisites such as tennis racquets and golf club shafts. It is a wood which deserves recognition for all purposes where strength and elasticity are required, but it is not recommended for boat-building as it has a tendency to swell when it becomes wet. Obtainable, in large sizes and fair quantities only, from the Chief Forest Officer, Andaman Islands; the Conservator of Forests, Utilisation Circle, Burma; or from Messrs. Martin & Co., Clive Street, Calcutta. The current (1928) price is Rs. 90 per ton f.o.b. Port Blair. It is also quoted at Rs. 100 per ton at Messrs. Martin & Co.'s yards, Calcutta.

The remaining three species mentioned above are not unlike the two already described.

Nana or benteak is a large and common tree on the West Coast, much used by local craftsmen for boat-building, house-construction and general work. Its weight is 45 lbs. per cubic foot (air-dry), and it is a good elastic timber where "spring" is required. It is, however, a very refractory wood to air-season. It can be kiln-seasoned without trouble but the process must be slow and carefully carried out. Enquiries should be addressed to the Forest Economist, Chepauk, Madras, or to the Chief Conservator of Forests, Poona, Bombay. Current price Rs. 60 to Rs. 90 per ton in the log f.o.r. South India. Bombay quotes Rs. 62 to Rs. 101 per ton in the log f.o.r. Bombay (July 1928).

Nandi is found all over India in the moist plains forests. It is very hard and heavy, rather difficult to work and apt to crack, but its durability, even underground, makes it a useful and much sought-after timber for house-posts and constructional work. If it is found that it can be kiln-seasoned without splitting, it will be a far more valuable timber than it is at present.

Enquiries should be addressed to the nearest Conservator of Forests.

Leza occurs only in Burma, in fair sizes and moderate quantities. It is a greyish-brown wood, fairly hard, durable, and close-grained. Weight 39 lbs. per cubic foot (air-dry). A little known wood which might command better attention. It is valued by the Burmese for bows and spears, and as the timbers selected for such articles are found usually to be of more than average merit, *leza* deserves further investigation. It is, however, apt to split and crack when drying, and this has probably mitigated against its more extensive use. It is obtainable through the Conservator of Forests, Utilisation Circle, Rangoon, Burma.

Mangifera indica.

Trade name.

Mango.

Vernacular names.

Am ; mangas (S. India) ; *thayet* (Burm.).

Weight.

42 lbs. per cubic foot (air-dry).

Description of the wood.

Mango wood is a dull greyish-brown, hard, strong, and durable under water. Generally rather coarse and with interlocked fibre. Easy to work, but difficult to finish cleanly.

Seasoning.

Not a difficult timber to season, but one which is apt to discolour if not dried soon after conversion.

Strength.

A few strength figures are available from Dehra Dun but mango has not, as yet, been tested under the full routine timber testing programme.

Uses.

Mango, like sissoo and toon, is another of India's " universal " woods. The tree is found throughout India, either wild or cultivated, and consequently is used for many purposes, including house-building, boat-building, well-curbs, agricultural implements, parts of carts, etc. It is also extensively used by tea gardens for tea-boxes and by other trades for packing cases. It is eminently suitable for planking, crates, or rough furniture, and is an excellent fuel wood.

Sources of supply.

Mango wood can usually be bought in any Indian bazaar or from local timber merchants. It is more a tree of cultivated coun-

try than a forest tree, but fairly large supplies can be obtained from the West Coast forests of Bombay and Madras.

Prices.

The price is dependent on local supply and demand, but mango wood is usually obtainable in plank and scantling form at about Re. 1 to Rs. 1-4-0 per cubic foot.

Mesua ferrea.

Trade name.

Mesua. Sometimes called iron-wood.

Vernacular names.

Nahor (Assam) *penaga ; nagesar ; gangaw* (Burm.).

Weight.

60 lbs. per cubic foot (air-dry).

Description of the wood.

Sapwood creamy-white ; heartwood dark brick-red, dulling on exposure. Very hard, strong and durable. It saws easily when green, but is too cross-grained to give a clean finish.

Seasoning.

If air-seasoned with ordinary care, this timber gives little trouble, though it has a tendency to crack if kept in stock unseasoned. It has not been kiln-seasoned as yet ; but should give no trouble in this respect, although it has the appearance of a refractory wood, and would probably have to be dealt with carefully.

Strength.

The strength figures for this timber are given in Appendix I. It may be noted that its strength figures are far greater than those of teak.

Uses.

The wood is really more suitable for sleepers and constructional work than for high class carpentry. It is too heavy for furniture, but for posts, beams, rafters, and ordinary building work, it is excellent, being durable, even against white ants, for many years.

Sources of supply.

The largest supplies come from Assam, where 2,000 to 3,000 tons are said to be available annually. Enquiries should be ad-

dressed to the Conservator of Forests, Shillong, Assam. Smaller supplies are available through the Conservator of Forests, Utilisation Circle, Rangoon, Burma ; the Chief Forest Officer, Andaman Islands ; and the Forest Economist, Chepauk, Madras.

Prices.

The Rangoon market quotes (1928) about Rs. 60 per ton f.o.b. in the log. Scantlings are quoted in South India at Rs. 2 per cubic foot.

Millettia pendula.

Trade name.

Thinwin.

Vernacular name.

Thinwin (Burm.).

Weight.

66 lbs. per cubic foot (air-dry).

Description of the wood.

A very beautiful wood of a brown chocolate colour, and invariably streaked with darker grain, which gives a handsome "partridge" figure on practically all tangentially cut planks. A very hard and heavy wood, but it works well to a bright metallic surface with sharp tools.

Seasoning.

A slow seasoner and one requiring good end protection when being air-seasoned. It has not as yet been kiln-seasoned at Dehra Dun.

Strength.

This timber has not been tested yet for strength at Dehra Dun.

Uses.

Rather heavy for light furniture, but its handsome appearance makes it a desirable wood for cabinet making, walking sticks, turnery, and other decorative work.

Sources of supply.

Available only from Burma. Enquiries should be addressed to the Conservator of Forests, Utilisation Circle, Rangoon.

Prices.

The price is quoted this year (1928) at about Rs. 60 per ton in the log f.o.b. Rangoon.

Morus species.

The *Morus* or mulberry family includes two or three well known woods of which *Morus indica* and *Morus laevigata* are perhaps the best known, and for commercial purposes, they can be graded together.

Trade name.

Mulberry. Has been called yellow mulberry in home markets.

Vernacular names.

Tut ; tutu.

Weight.

40 lbs. per cubic foot (air-dry).

Description of the wood.

The sapwood is a golden-brown colour which dulls down on exposure. Fairly hard, but working extremely easily to a clean finish.

Seasoning.

Mulberry is fairly easy to air-season and to kiln-season. There is a tendency to warp but this can be reduced by care in stacking the timber prior to drying .

Strength.

This wood has not been tested, as yet, for strength at Dehra Dun, but strength figures will be available shortly.

Uses.

Mulberry is a good light-coloured medium-weight wood which deserves more recognition. Unfortunately supplies are limited. It is well known in North India as a substitute for English ash, for hockey-sticks, tennis-racquets, and other sporting requisites. This alone is an excellent recommendation, as substitutes for ash are not common in India. It also turns and carves to a clean finish and makes excellent light furniture.

Sources of supply.

The Changa Manga plantations in the Punjab produce fair quantities annually, and enquiries should be addressed to the Conservator of Forests, Utilisation Circle, Lahore, Punjab. Smaller quantities are usually available from the United Provinces, Bihar and Orissa, Bengal, Assam and Burma.

Prices.

No recent quotations are to hand but prices can always be obtained from the Conservator of Forests, Utilisation Circle, Lahore. The price usually runs at about Rs. 1-8-0 to Rs. 2-8-0 per cubic foot for logs at forest depots.

Odina Wodier.

Trade name.

Wodier.

Vernacular names.

Jhingan ; mohin ; nabe (Burm.).

Weight.

35 lbs. per cubic foot (air-dry).

Description of the wood.

Sapwood greyish-white. Heartwood dull brick-red, moderately hard, generally small, and with spiral grain. An easy timber to saw, work, turn and finish to a clean surface.

Seasoning.

If carefully stacked and protected from dry winds, it air-seasons with small degrade. It is, however, one of the slowest of Indian timbers to season. It is very difficult, if not impossible, to kiln-season the heartwood as the heat seems to affect the gum in the wood which makes an impermeable layer which blocks the outward passage of internal moisture. The sapwood, which contains little or no gum, kiln-seasons easily.

Strength.

Strength figures for this timber are given in the table in Appendix I.

Uses.

A fair general utility wood which is well known throughout India, chiefly because it is a common tree. It cannot be called a first class furniture wood but, nevertheless, it is used extensively for house-construction, agricultural implements, parts of carts, and other rural work. It has been tried and proved extremely good for boot-lasts and cutting-blocks. It is also an excellent wood for delicate carvings and turnery, and generally deserves more attention in this direction. It has proved useful for brushbacks.

Sources of supply.

One of the commonest trees of the plains of India. It can usually be purchased from local timber merchants. An enquiry addressed to the nearest Divisional Forest Officer will always bring information as to the best means of obtaining this wood.

Prices.

Usually obtainable at about Rs. 10 or Rs. 15 per ton or even less in many places, though prices may be higher where the wood is used by local craftsmen.

Olea ferruginea and Parrotia Jacquemontiana.

Both these timbers are very hard, close-grained, strong, elastic, and tough, and eminently suited for tool handles and axe-helves. As they both occur in the North-West Himalayas at high altitudes, are both small trees, and the woods are similar and suitable for the same purposes, they have been classified together.

Trade names.

Olive (*Olea ferruginea*) ; parrotia (*Parrotia Jacquemontiana*).

Vernacular names.

Khau or *kow* (*Olea*) ; *paser* (*Parrotia*).

Weight.

Olea is about 60 lbs. per cubic foot (air-dry), and *Parrotia* about 48 lbs. per cubic foot (air-dry).

Description of the woods.

Olive is a light-brown or olive-brown wood, often with fine marble grain. *Parrotia* is pale pink. Both are very close-grained and finish to a very smooth surface.

Seasoning.

No reliable data are to hand regarding the seasoning of these two species, but they have the appearance of being refractory woods and would probably require careful and slow drying.

Strength.

Both these timbers have been tested for their suitability as hammer and tool handles, and information regarding them can be obtained from the Forest Economist, Forest Research Institute, Dehra Dun.

Uses.

As mentioned above, both these timbers have been tested at Dehra Dun and as a result they have been registered as very suitable for tool and axe-helves. In this respect they are in no way

inferior to European ash, though somewhat heavier. They are also both eminently suitable for small turnery work, inlay, and decorative articles.

Sources of supply.

Obtainable only in very small sizes and in limited parcels on application to the Conservator of Forests, Utilisation Circle, Lahore, Punjab ; the Deputy Conservator of Forests, Abbottabad, North-West Frontier Province, or the Conservator of Forests, Utilisation Circle, Srinagar, Kashmir.

Prices.

Prices should be obtained from local officers. These woods are usually sold in billet form at so much each, or per score.

Ougeinia dalbergioides.

Trade name.

Sandan.

Vernacular names.

Sandan ; tinnas ; tewas.

Weight.

55 lbs. per cubic foot (air-dry).

Description of the wood.

A greyish-brown or light reddish-brown wood, usually mottled, and often very handsome. Hard, close-grained, elastic and tough, and often with interlocked fibre. Fairly easy to work and finish cleanly. The centre of large trees is usually unsound.

Seasoning.

Air-seasons slowly, but without much difficulty or degrade under ordinary air-seasoning conditions. It also kiln-seasons readily with negligible depreciation.

Strength.

This timber has not yet been tested under the routine timber testing programme at Dehra Dun.

Uses.

Being tough and elastic, it is a useful wood for cart-shafts, tool-handles, axe-helves, picker-arms, and similar work. It is also a handsome furniture wood and is already well known in most parts of India as an excellent all-round timber.

Sources of supply.

A common tree in practically all the plains forests of India. It is most abundant in Central India, Bihar and Orissa, and on the West Coast.

Enquiries should be sent to the nearest Conservator of Forests, who will always put intending purchasers in touch with the nearest supplies.

Prices.

Central Indian quotations this year (1928) are approximately Rs. 100 to Rs. 125 per ton for logs at Ballarshah depot. In East India it is quoted at Rs. 110 per ton.

Pentace burmanica.

Trade name.

Thitka. Called Burma mahogany in European markets.

Vernacular name.

Thitka (Burm.).

Weight.

40 lbs. per cubic foot (air-dry).

Description of the wood.

Thitka is a light pinkish-red timber, even-grained, and with a glossy sheen. It works very easily to a fine smooth surface and takes an excellent polish. Not unlike pale mahogany in appearance.

Seasoning.

Air-seasons without difficulty if properly stacked and protected. Small quantities have also been kiln-seasoned without difficulty.

Strength.

Thitka has not been fully tested under the timber testing programme at Dehra Dun. It is under test at the present time.

Uses.

A timber which has come to the fore since the British Empire Exhibition of 1924, where it was recognised as a valuable wood which had hitherto been little known. It is a timber which can be recommended for bedroom furniture, shop fittings, and all cabinet work of light colour. It should also prove excellent for plywood and tea-boxes.

Sources of supply.

Obtainable only from Burma, in fair quantities and good size logs or squares. Enquiries should be addressed to the Conservator of Forests, Utilisation Circle, Rangoon.

Prices.

Rangoon quotes Rs. 90 to Rs. 110 per ton this year (1928), but the price is more likely to rise than otherwise as the wood gets better known in India.

Phoebe Hainesiana.

Trade name.

Bonsum (sometimes called Assam teak).

Vernacular name.

Bonsum.

Description of the wood.

Freshly cut timber looks like pale Burma teak with a slight olive-green tinge. On exposure, the greenish colour disappears and the wood remains almost exactly the same colour as teak. It is an extremely easy timber to work and finish to a clean surface.

Seasoning.

Gives very little trouble when seasoning and, when dry, it appears to be very little affected by climatic changes. Specimen furniture made from kiln-seasoned wood at Dehra Dun has been through a hot weather and "rains" without any movement at all. It appears to be a model wood in this respect.

Strength.

Is under test at present and strength figures will be available shortly. Weight about 36 lbs. per cubic foot (air-dry).

Uses.

Appears to be a most suitable wood for all purposes where lightness and stability are required. It is recommended especially for light camp furniture where great strength is not wanted.

Sources of supply.

It occurs only in Assam and possibly in small quantities in Bengal. In Assam it is fairly plentiful and the Conservator of Forests estimates that he can supply at least 1,000 tons per annum Enquiries should be addressed to the Conservator of Forests, Shillong, Assam.

Prices.

The price of bonsum will probably rise as the wood becomes better known. At present the price is very moderate. It is probable that other species are sold under the name of *bonsum* so care should be taken to specify *Phoebe Hainesiana.*

Pinus longifolia.

Trade name.

Chir ; long-leaved pine.

Vernacular names.

Chir ; chil.

Weight.

33 to 38 lbs. per cubic foot (air-dry).

Description of the wood.

Chir wood is well known in North India as an excellent "deal" timber. Next to deodar, it is used more than any other coniferous wood. The sapwood is white ; the heartwood reddish straw-colour with darker coloured resin ducts on longitudinal sections. An easy timber to work and finish, but large dead knots and a spiral-grain in many logs are distinct drawbacks to an otherwise excellent "deal" wood.

Seasoning.

An easy timber to air-season or kiln-season without depreciation. Spiral-grained stock is, naturally, very liable to warp and cup, and when purchasing, a spiral of more than 1 in 20 should be avoided.

Strength.

The strength values, compared with teak, are given in Appendix I.

Uses.

An excellent timber for cheap joinery, match-boarding, and other constructional stock. If treated, it makes a good cheap sleeper with a life of about 12 years. Also used for shingles, packing cases, rough furniture, etc., and is perfectly suitable for all purposes for which European or American "deal" woods are used.

Sources of supply.

Large supplies are available annually from the United Provinces or from the Punjab. The timber is usually extracted in sleeper form but logs of big dimensions may be purchased from Punjab river depots. Applications should be addressed to the Chief Conservator of Forests, Naini Tal, United Provinces, or to the Conservator of Forests, Utilisation Circle, Lahore, Punjab.

Prices.

First class logs are quoted this year (1928) at Jhelum at Rs. 50, second class logs at Rs. 30, and third class at Rs. 15, per ton of 50 cubic feet. B. G. sleepers are quoted at about Rs. 3-0-0 each and M. G. at about Rs. 1-12-0.

Pinus excelsa.

Kail ; blue pine.

Weight about 32 lbs. per cubic foot (air-dry).

Another well known " deal " wood. Heartwood pale red and very resinous, easy to work and bring to a clean finish. Kail is a superior wood to chir for most purposes, and is suitable for high-class joinery, furniture interiors, cores for ply-wood, etc. It has also proved excellent for pattern-making, drawing-boards, and plane-tables. A very easy timber to season and one which does not warp or twist.

Available in large quantities, if there is a demand, from the United Provinces and Punjab. Enquiries as for chir.

The strength figures of blue pine are given in Appendix I.

The price is usually a little above that of chir wood. It is quoted this year (1928) at Rs. 40 to Rs. 50 per ton f.o.r. Jhelum.

Pterocarpus species.

This family includes four of India's most important commercial timbers, namely :—*Pterocarpus dalbergioides* (Andaman padauk) ; *Pterocarpus macrocarpus* (Burma padauk) ; *Pterocarpus Marsupium* (bijasal) ; and *Pterocarpus santalinus* (red sanders).

Pterocarpus dalbergioides.

Andaman padauk. Weight 45 lbs. per cubic foot. Sapwood grey or dirty white. Heartwood usually bright crimson, dulling to dark brown on exposure to light. Varieties shading from pale golden yellow to blood red are not uncommon. Often finely marked with darker red or black streaks. Very pale red or yellow-coloured wood is known as " off-colour " padauk. The wood has rather interlocked fibre but with sharp tools it works fairly easily and finishes to a fine surface which polishes beautifully.

An easy timber to air-season or kiln-season with negligible depreciation.

Andaman padauk is one of India's most valuable cabinet, ornamental, and constructional woods. It is already well known on European markets and demands a high price which restricts its use to high class ornamental work. Very suitable for billiard tables, dining tables, cabinet work of all sorts, and panelling. It is very strong, durable, and elastic, and is consequently used by the Ordnance and Railway Departments for gun-carriage work and railway-carriage construction. It is obtainable only from the Andamans. Enquiries should be addressed to the Chief Forest Officer, Andaman Islands, or to Messrs. Martin & Co., Clive Street, Calcutta, the Government Agents for Andaman timbers.

The price in Calcutta this year (1928) is approximately Rs. 140 per ton for large logs or squares.

The strength figures of Andaman padauk are given in Appendix I.

Pterocarpus macrocarpus.

Burma padauk. Weight 54 lbs. per cubic foot. Wood very similar to Andaman padauk but the colour is less brilliant and more a brown-red or brick-red, and not so finely marked with dark streaks. In strength qualities and durability, it is similar to, if

not superior to, Andaman padauk, and is preferred by the Ordnance Department for wheel felloes and spokes, and other ordnance work. It is recommended for parquetting work and floornigs, furniture and general cabinet work of all kinds. It is an easy wood to season.

Obtainable in large sizes from the Conservator of Forests, Utilisation Circle, Rangoon, Burma. The current price in Calcutta is about Rs. 125 per ton for large squares. The price f.o.b. Rangoon would be about Rs. 100 per ton for the same class of timber. About 1,000 tons per annum is the estimated output. The strength figures are given in Appendix I.

Pterocarpus Marsupium.

Bijasal, *roune*, *vengai*, etc. Weight 50 lbs. per cubic foot. Colour golden-brown. A hard, durable and handsome wood. well known in South India as a remarkably fine timber. Seasons easily without degrade, and works to a clean finish. It is not much affected by changes in humidity and temperature, and can be recommended as an excellent wood for high class cabinet work and delicate furniture. Obtainable in fair quantities in Central and South India, but the trees are scattered. Enquiries should be addressed to the Chief Conservator of Forests, Nagpur, C. P.; the Chief Conservator of Forests, Poona, Bombay; or the Forest Economist, Chepauk, Madras. The strength figures are given in Appendix I. Current prices range at about Rs. 60 to Rs. 75 per ton for logs or rough squares f.o.r. at timber depots. Bombay quote Rs. 51 to Rs. 61 per ton at forest stations and Rs. 110 to Rs. 117 per ton f.o.r. Bombay (July 1928).

Pterocarpus santalinus.

Red sanders; *lal chandan*.

Weight 76 lbs. per cubic foot (air-dry). Very similar in appearance to dark Andaman padauk but this wood is much harder and heavier. Extremely strong and durable and undoubtedly one of India's most handsome woods. Its great weight and hardness is against it for cabinet work and furniture, but it is extensively used in India for ornamental work, carvings, and turnery. It is an easy

wood to season. Available in fair quantities from Madras only. Enquiries should be addressed to the Forest Economist, Chepauk, Madras, who will also supply information regarding current prices in Madras.

Sageraea elliptica.

Trade name.

Chooi. Has been known as Andaman bow-wood.

Vernacular name.

Chooi (And.).

Weight.

54 lbs. per cubic foot (air-dry).

Description of the wood.

A close-grained long-fibred wood of pale lemon yellow colour. Very strong, but only procurable in small sizes. Splits well into long straight lengths. Works easily and finishes to a fine clean surface. Would be an excellent substitute for hickory if it was slightly more elastic. It is very pliable but has little "spring-back." This might perhaps be rectified with special drying treatment, as elasticity can often be improved with special treatment when wood is being kiln-seasoned.

Seasoning.

Under ordinary seasoning conditions, this timber air-seasons without difficulty. If kiln-seasoned it should come out without degrade of any sort.

Strength.

The strength values are given in Appendix I. It will be seen that this timber compares very favourably with teak.

Uses.

A very useful wood which has come to the fore during the last few years, as an excellent substitute for ash and possibly hickory, although it has not got quite the same elasticity as the latter. It is, nevertheless, a wood which can be recommended for tool handles,

axe-helves, golf club shafts, and other articles where a strong straight-fibred wood is required. Has done well in motor car hood supports, and also as a fishing-rod timber. It is, however, apt to remain bent for a time after severe fishing, but this bend straightens out usually within 24 hours if the rod is hung up. It makes an extremely strong rod.

Sources of supply.

Obtainable only through the Chief Forest Officer, Port Blair, Andaman Islands, or from Messrs. Martin & Co., Clive Street, Calcutta, the Government Agents for Andaman timbers, from whom prices can be ascertained.

Santalum album.

Trade name.

Sandal wood.

Vernacular name.

Chandan.

Weight.

60 lbs. per cubic foot (air-dry).

Description of the wood.

Sandal is too well known to require description, the close-grained, yellow-brown wood, with its strong distinctive odour, being familiar throughout India to Europeans and Indians alike. It is probably the most valuable tree in the world, and every part of the tree, including the roots, fetches its price.

The market grades of sandalwood are most detailed, and the different portions of the tree are divided up into billets of various sizes—rootwood, chips, sawdust, etc., and each lot is sold by weight, probably the only case of its kind where this is done on any large scale.

The chief use of the wood is for the extraction of sandalwood oil but the demand for other purposes is by no means small. It is recognised as the premier carving wood of India, and Indian sandalwood carvings and small ornamental boxes are famous throughout the world. It also plays an important part in the religious ceremonies of Hindus and Parsis and is used for making caste marks. In addition to the local demand, large quantities are exported, especially to China, where the wood is used for making coffins. Enquiries for sandalwood should be addressed to the Forest Economist, Madras; the Chief Conservator of Forests, Poona, Bombay, or to the Chief Forest Officers of Mysore and Coorg. The biggest supplies come from Mysore.

Prices.

Prices vary considerably, every portion of the tree having a value.

Shorea species.

The *Shorea* family includes several trees of first importance to India. Chief among these is *Shorea robusta ;* the well-known *sal* tree. Other species of importance are *Shorea assamica* (*makai*) and *Shorea obtusa* (*thitya*).

Shorea robusta.

Trade name.

Sal.

Vernacular name.

Sal.

Weight.

50 to 56 lbs. per cubic foot (air-dry).

Description of the wood.

The very hard cross-fibred pinky-brown wood of *sal* is well known to most timber merchants in India. It is a very hard, heavy, but extremely strong wood, and the durability of the heartwood, even against white ants, places it, next to *pyinkado*, as India's best sleeper wood. It is not a difficult timber to work, but the cross-fibred nature of the wood renders it difficult to bring to a clean finish, unless a hard and sharp tool is used.

Seasoning.

Sal is very liable to fine surface cracks when seasoning, but these do not depreciate the value of the timber for constructional work, to any appreciable extent. Except for this, the timber air-seasons in stock sizes slowly but without difficulty, but is sometimes liable to excessive warping when coming off the saw, due to the spirally interlocked bands of fibre. Kiln-seasoned stock dries out with small degrade, but *sal* is not an easy timber to kiln-season.

Strength.

The strength values for *sal*, as compared to teak, are given in Appendix I.

Uses.

The primary use of *sal* in India is for sleepers, for which it is eminently suitable. It is also the chief constructional timber of North, Central, and East India. The sapwood is perishable and is soon attacked by fungus and insects. If treated with a preservative, however, the sapwood of *sal* becomes equal to, if not superior to, the heartwood. The importance of this little known fact, especially in connection with the conversion of small logs to sleeper sizes cannot be over emphasised. *Sal* heartwood does not absorb creosote, even under pressure, but this is all to the good in the case of sleepers of heartwood and sapwood mixed, as it would be a waste of oil to treat the heartwood.

Sources of supply.

Sal occurs along the foot of the Himalayas, in Nepal, and in Central India. It can be purchased from most timber merchants of the United Provinces, Central Provinces, Bihar and Orissa, Bengal, Assam and North Madras. Enquiries for large supplies should be addressed to the nearest Conservator of Forests in the Provinces named above.

Prices.

The price of *sal* naturally varies considerably according to the accessibility of the annual coupes in the forest and their proximity or otherwise to a railway station. Trees are often sold standing in the forest for 4 annas a cubic foot, while the timber from the same tree is retailed at Rs. 3 per cubic foot at a railway depot. On the other hand, *sal* trees standing near a railway station might fetch Rs. 2 per cubic foot standing and be retailed at Rs. 2-8-0 per cubic foot at the depot.

B. G. sleepers are quoted this year (1928) at Rs. 7-8-0 each. The highest price was reached in 1922 when they touched Rs. 9-8-0.

Shorea assamica.

Makai. Weight 37 lbs. per cubic foot (air-dry). A rather soft, light-brown wood which is little known outside Assam and Bengal. It is a useful light wood which should find a readier market than it does.

Enquiries should be addressed to the Conservator of Forests, Shillong, Assam.

The current price is moderate, Rs. 60 to Rs. 70 being quoted for first class logs at forest depots.

Shorea obtusa.

Thitya. Weight 65 lbs. per cubic foot (air-dry). Very similar in appearance to *sal* but not so coarse. A very hard and heavy timber and one eminently suited for heavy construction work. It is at present used extensively for sleepers and is sold, together with *Pentacme suavis* (*ingyin*) which is almost identical with it, as *thitya-ingyin* timber, the two woods being classed for commercial purposes as one. It is a very durable wood, even under ground, and if it were not for teak and *pyinkado*, this timber would hold the same place in Burma, as *sal* does in India.

Enquiries should be addressed to the Conservator of Forests, Utilisation Circle, Rangoon, Burma, the only Province in which the tree is found.

It is quoted this year at the very moderate figure of Rs. 50 to Rs. 55 per ton f.o.b. Rangoon. The strength figures of *thitya* are given in Appendix I.

Sterculia campanulata.

Trade name.

Papita.

Vernacular name.

Papita.

Weight.

About 25 lbs. per cubic foot (air-dry).

Description of the wood.

A very light white wood with little strength and not resistant to white ants. It is also very liable to discolour within a short time after conversion if not dried out immediately.

Seasoning.

It is doubtful whether *papita* can be air-seasoned quickly enough to prevent staining by fungi. On the other hand, if it is kiln-seasoned immediately after conversion, it gives no trouble at all, and remains white for years.

Strength.

Papita should not be used where strength is required. A very popular match splint wood, but the matches are on the weak side. Quite suitable for packing-cases and boxes, where lightness is a consideration.

Sources of supply.

Obtainable chiefly from the Andaman Islands or from their Agents, Messrs. Martin & Co., Calcutta, who generally carry stocks in the log. Small supplies might also be procured from Burma.

Prices.

The current price of *papita* (1928) is about Rs. 30 per ton in the log f.o.b. Port Blair, while in Calcutta it would probably be about Rs. 45 per ton in the log.

Tectona grandis.

Trade name.

Teak.

Vernacular names.

Sagun (Hind) ; *kyun* (Burm.) ; *teku* (Tamil).

Weight.

38-43 lbs. per cubic foot (air-dry).

Description of the wood.

Sapwood greyish-white ; heartwood light golden brown. Burma and Malabar teak usually fairly straight-grained and light in colour, Central Provinces and Bombay teak often much darker and streaked with dark brown or almost black veining. Teak darkens considerably when seasoned, and with great age the wood often turns nearly black.

Seasoning.

Air-seasons easily, and if properly stacked with a good air circulation, it can be dried quickly with little or no depreciation.

Can be kiln-seasoned, but care is needed as surface oxidization is apt to discolour the wood. This can, however, be avoided by proper treatment without difficulty.

Strength.

In Appendix I, the combined strength figures of Burma and Malabar teak, which are practically equal, have been taken as the standard. Other timbers are shown in the strength table as percentages of Burma and Malabar teak, whose strength values have been taken as 100 in each case. Thus an easy comparison can be made at a glance.

Uses.

Teak is too well-known in India to need description. It is the chief timber used by the Railways for their carriage and wagon

construction and is the main furniture wood of the country. Its popularity is due to its relatively small coefficient of expansion and contraction, and the fact that it is extremely durable and, practically speaking, immune to insect and fungus attack. Burma teak is stronger than Central Provinces and Bombay teak, but the timber from these two provinces is decidedly more handsome than that from Burma. Put briefly, teak from Burma and Malabar are preferable for constructional work, but for beauty of grain and handsome "figure", the dark coloured timber obtainable from the Deccan and the Dangs is hard to beat.

Sources of supply.

1. *Burma Teak.*—Logs or squares of large dimensions are obtainable direct from the Conservator of Forests, Utilisation Circle, Rangoon, Burma, or from the many well-known firms dealing in this timber in Burma and Calcutta. Squares can be purchased in Calcutta from Messrs. Martin & Co., Clive Street, Calcutta, the Government Agents for Indian timbers.

2. *Malabar Teak.*—Apply to the Forest Economist, Chepauk, Madras. Small supplies of logs, squares and converted material are usually to be had from stock at Nilambur and Pollachi.

Central Provinces Teak.—Apply to the Chief Conservator of Forests, Nagpur, Central Provinces. Usually sold in log form. Very large logs not available.

4. *Bombay Teak.*—Apply to the Chief Conservator of Forests, Poona, Bombay. Specially selected dark coloured logs can be bought by arrangement.

Prices.

Teak prices are at the present time rather on the high side and it is unlikely that the price will fall to any considerable extent, the demand usually keeping above the supply. The latest figures for Burma Government teak are as follows :—

4 star logs Rs. 140 per ton (Rangoon auctions). The Calcutta market quotes Rs. 265 to Rs. 270 per ton for selected 1st class logs. C. P. teak is usually at about Rs. 150 per ton.

Terminalia species.

This family contains several well-known commercial woods, some of which are of great value to India. The following are the best known of these :—

Terminalia bialata (silvergrey) ; *Terminalia Manii* (black chuglam) : *Terminalia myriocarpa* (hollock) ; *Terminalia procera* (*badam*) : *Terminalia paniculata* (*kindal*) ; and *Terminalia tomentosa* (laurel).

Terminalia bialata.

Silvergrey (heartwood) ; white chuglam (sapwood) ; Weight 43 lbs. per cubic foot (air-dry). Sapwood cream colour ; heartwood mottled silvergrey. Sapwood logs are usually called chuglam ; while good heartwood logs are sold as silvergrey. I refer to the two different coloured woods as sapwood and heartwood, but it has not been decided as yet whether silvergrey is really true heartwood or only false heartwood, due to colouration, and having no connection with the formation of true heartwood. Silvergrey wood was brought to the notice of European markets at the Exhibitions of 1919 and 1924. It now obtains a high price in Europe for panelling and furniture. The wood air-seasons and kiln-seasons easily, but it has been found that it is often liable to fine surface hair-cracks, even after seasoning. This is not always the case, some silvergrey standing up even in the hottest climates without fault. It is an extremely handsome panel wood, and the grey colour improves rather than diminishes with age.

Strength values are given in the table in Appendix I. When separated into silvergrey and white chuglam, the latter proved to be slightly the stronger of the two.

Both timbers are procurable in considerable quantities and in large sizes from the Chief Forest Officer, Port Blair, Andaman Islands, or from Messrs. Martin & Co., Clive Street, Calcutta.

This timber is quoted at Calcutta at Rs. 100 per ton for first class logs. The white portion of the tree, known as white chuglam is a useful " utility " wood.

Terminalia Manii.

Black chuglam ; sometimes known as almond or harewood, but these are not good names. Weight 51 lbs. per cubic foot (air-dry).

Heartwood dark greyish-brown, strong, hard, close-grained, and finishing to a clean surface.

Can be seasoned both naturally and artificially without degrade, but this is difficult, and the wood is sometimes apt to develop end splits. An excellent timber for strong structural work.

Obtainable in squares, up to 60 ft. long × 24 inch sidings, from the Conservator of Forests, Utilisation Circle, Rangoon, Burma, or from the Chief Forest Officer, Andaman Islands. It is quoted at Rs. 80 to Rs. 100 per ton in the Calcutta market this year (1928).

Terminalia myriocarpa.

Hollock ; *panisaj*. Weight 39 lbs. per cubic foot (air-dry). Occurs only in Assam, Sikkim, and in Upper Burma. Seasons very satisfactorily. Saws and works easily. A good general utility wood, suitable for carriage-building and general construction. Available in large quantities and quoted this year (1928) at Rs. 56 per ton f.o.b. forest railway stations in Assam.

Terminalia procera.

Badam or *bombwe*. Very similar to black chuglam and can be treated as identical for commercial purposes. Weight 39 lbs. per cubic foot (air-dry). Obtainable from the same sources at approximately the same price. Available in large quantities in squares up to 40 feet long × 15 inch sidings. Strength figures for this timber are given in the table in Appendix I.

Terminalia paniculata.

Kindal, *hongal*. Weight 47 lbs. per cubic foot (air-dry). Heartwood greyish-yellow, hard, close-grained and finishing to a clean surface.

Seasons with small degrade and kiln-seasons without difficulty but rather prone to end-splitting and cracking even after seasoning. A useful utility timber, available in large quantities on the West Coast. Recommended for beams, rafters, battens and similar work, but not for furniture. Enquiries should be addressed to the Chief Conservator of Forests, Poona, Bombay, or the Forest Economist, Chepauk, Madras.

Current prices are Rs. 45 to Rs. 60 per ton in the log in Bombay Presidency and Rs. 88 per ton f.o.r. West Coast of Madras.

Terminalia tomentosa.

Laurel; *sain*; *asna*; *matti* (Southern India); *taukkyan* (Burm.). Weight 53 lbs. per cubic foot (air-dry). Laurel is one of the most widely distributed and commonest trees in India and Burma, but it has a bad reputation for blunting tools and not air-seasoning easily. The former complaint is more a popular prejudice than a fact. The timber is admittedly fairly hard but it works without great difficulty to a clean finish. Air-seasoning is a different matter. It is a difficult timber to air-season and is very liable to end cracking and warping. Kiln-seasoning on the other hand, gives excellent results, and large scale experiments have proved that laurel can be kiln-seasoned easily and without depreciation of any kind.

The heartwood is often extremely handsome and finely figured logs are not uncommon from South India and Burma. North Indian laurel is more often dull and without figure of any sort. At the British Empire Exhibition at Wembley, figured laurel was noted as the most handsome of all the British Empire woods exhibited, and if the timber is kiln-seasoned there is little doubt that it is a wood of great value for high class cabinet and furniture work. Being a very strong wood, ordinary unfigured stock is very suitable for house construction and similar utility work.

The best quality logs are obtainable on application to the Forest Economist, Chepauk, Madras, or to the Conservator of Forests, Utilisation Circle, Rangoon, Burma, but as the tree occurs

sporadically practically all over India, except in the extreme North, an enquiry addressed to the nearest Conservator of Forests, will always bring information as to the best source of supply.

The price varies so considerably that it is quite impossible to give quotations to cover the whole of India. Burma quotes Rs. 45 to Rs. 70 per ton f. o. r. Rangoon. Strength figures for laurel are given in Appendix I.

Xylia dolabriformis.

Trade name.

Pyinkado, ironwood of Burma.

Vernacular name.

Pyinkado (Burm.).

Weight.

57 lbs. per cubic foot (air-dry).

Description of the wood.

Heartwood dark reddish-brown, very hard, durable, and somewhat cross-grained. The wood gets harder with age and consequently more difficult to work. When green it saws easily. *Pyinkado* from Burma is superior to the South India species (*Xylia xylocarpa*), both as regards strength and durability.

Seasoning.

Air-seasons slowly but without trouble or degrade. Has not been kiln-seasoned at Dehra Dun.

Strength.

The value of *pyinkado* lies more in its great hardness and durability rather than its strength. Strength figures are, however, available and are given in the table in Appendix I.

Uses.

The chief use of *pyinkado* is for Railway sleepers, for which purpose it is probably the best wood in the world, an average life in the line of 18 to 20 years being common. It is also a useful wood for paving-blocks, tent-pegs, agricultural implements, and other requirements where its special qualities are called for.

Sources of supply.

Burma *pyinkado* is obtainable through the Conservator of Forests, Utilisation Circle, Rangoon. South Indian *pyinkado* may be had on application to the Forest Economist, Chepauk, Madras, or the Chief Conservator of Forests, Poona, Bombay.

Prices.

Burma quotes Rs. 50 to Rs. 55 per ton, in the log f.o.b. Rangoon (1928).

Xylia xylocarpa.

Irul. Weight 52 lbs. per cubic foot (air-dry). Occurs in South India only. A refractory timber to season, and difficult to work, but very strong and more durable than most Indian woods. Available in very large quantities usually at about Rs. 80 to Rs. 90 per ton f.o.r. West Coast of Madras. Very suitable for constructional work and sleepers. Strength values are given in the table in Appendix I.

CHAPTER VI.

Woods recommended for special uses.

India possesses some 2,500 woody species amongst her *flora*. There is, therefore, a wide choice for anyone requiring timber for a specific purpose, and the odds are often in favour of the wrong kind of wood being chosen, the result being that the wood itself usually gets blamed, whereas it is really the user who is at fault. A little advice, therefore, as to those woods which are suitable for different purposes may not be out of place.

Between the cork-like wood of *Erythrina* and the iron-like hardness of *pyinkado*, there is a wide range, and to allot every species and type of wood to its proper sphere is not the work of a moment. Such perfection can only be attained after years of research and trial, and it was with this object in view that the Economic Branch of the Forest Research Institute was started at Dehra Dun some 18 years ago. As the work of research proceeds, it becomes more and more evident that India possesses timbers which are unsurpassed by any other country, but the practical utilisation of the lesser known timbers has been hindered by a curious circumstance. This circumstance can be summed up in the one word "teak". For years past, teak has been the watchword in India. It is what one might call a fool-proof wood, and its durability and adaptability soon made it famous throughout the world. With such a timber available in good quantities, Indian users looked no further for possible substitutes, until the inevitable began to happen, and supplies became more restricted, resulting in a very rapid rise of price. Then, at last, India began to look to the rest of her timbers, and although considerable progress has been made to date, it will be some years yet before she knows exactly what her resources in this direction are, and still more time will be required before the industrial world is satisfied that these other timbers will answer the purpose for which they are required. In addition to teak, such timbers as sal, deodar, chir, sissoo, and a few others, were used fairly extensively in those parts where they occurred, but beyond these, the commercial

exploitation of the many hundreds of other so-called Indian "junglewoods" was a thing unknown.

The following pages may, therefore, be of help as a guide as to which timbers to select for any given purpose. It is impossible to recommend a wood for every purpose for which wood is used, but the examples given are fairly representative, and will it is hoped give users an idea of the type of wood suitable for their special needs.

I. Constructional woods.

By constructional woods is usually meant those timbers used for superstructures, which include all parts of buildings, bridges, and similar structures not actually in contact with water or the earth.

The demand for this type of work is naturally very large, and in India, which is a well forested country, the timber utilised in superstructures exceeds that of all other industries both in value and quantity.

For the superstructures of permanent buildings, timber should be *strong* and *durable*. Lightness is an asset, if strength and durability are not sacrificed. Floor and wall planking should be *non-warping* and *non-shrinking*, and the wood for interior work, panels, etc., should be *ornamental*.

For external work, timber can be treated with preservatives to increase its durability (See Chapter IV). Timbers answering to the above specifications are numerous in India, but there are three woods which stand out above all others as building timbers, due chiefly to their being available in large quantities. These are teak, sal, and deodar. They are all strong, and what is more important in India where the white ant is so plentiful, they are *durable* timbers. In addition to these three, the following list, though representing only a few of the woods used for building, comprises some of the best and most commonly used structural timbers of India.

Abies Pindrow (silver fir). White and soft. Makes good treated shingles.

Acacia arabica (babul). Very hard and durable. Excellent for house posts.

Albizzia Lebbek and Albizzia procera (kokko or siris). Strong and handsome.

Artocarpus species (aini, chaplash, etc.). Moderately hard, durable, and often ornamental.

Calophyllum species (poon). Very strong and elastic. Beams and rafters. Also very handsome in panelling.

Cedrela Toona (toon). Ornamental. Suitable for light furniture, panelling, etc.

Chukrasia tabularis (chikrassy). Ornamental. Panelling, etc. A medium hard wood.

Bischofia javanica (bishop wood). Very durable under water but perishable above ground.

Dalbergia latifolia (rosewood or blackwood). Very strong and handsome. Excellent for furniture.

Dalbergia Sissoo (sissoo). Strong and ornamental. The best chair wood.

Dipterocarpus spp. (gurjan, eng, etc.). Used extensively in Burma. Excellent for floorings.

Duabanga sonneratioides (lampati). Does not warp or split. Rather a soft wood.

Eugenia Jambolana (jaman). A useful utility wood.

Hardwickia binata (anjan). Very strong and hard. Beams.

Heritiera minor (sundri). Very heavy, strong and tough.

Hopea species (hopea, thingan, etc.). Strong, tough and durable.

Lagerstroemia species (benteak, pyinma, etc.). Strong and elastic.

Mesua ferrea (mesua). Strong, heavy, and very hard.

Picea Morinda (Himalayan spruce). Soft and white. A good substitute for deal.

Pinus species (chir, kail, etc.). A soft deal wood. Easily treated.

Pterocarpus species (padauk). Very strong, durable and handsome.

Shorea species (thitya, makai, etc.). Very strong, tough, and durable.

Terminalia species (laurel, white chuglam, etc.). Variable. Sometimes very ornamental.

Xylia species (pyinkado). Extremely strong, hard, and durable.

II. Woods used in contact with the ground.

(*a*) *Piles.*

Great durability is required, also *resistance to shear and split.* The following are good :—

Acacia species (babul, etc.).
Artocarpus species (aini, etc.).
Cedrus Deodara (deodar).
Hardwickia binata (anjan).
Heritiera minor (sundri).
Hopea spp. (thingan, etc.).
Lagerstroemia species (durable under water).
Mesua ferrea (mesua).
Shorea spp. (sal, makai, etc.).
Tectona grandis (teak).
Terminalia tomentosa (laurel).
Xylia dolabriformis (pyinkado).

(*b*) *House and fence posts.*

Durability is again the main factor, while *strength* and *straightness* are required for house posts. The species mentioned for piles are all suitable, and, in addition, the following may be mentioned :—

Albizza Lebbek (kokko or siris).
Bischofia javanica (bishop wood).
Cupressus torulosa (Himalayan cypress).
Diospyros Melanoxylon (tendu).
Gmelina arborea (gumhar).
Ougeinia dalbergioides (sandan).
Pterocarpus macrocarpus (Burma padauk).
Pterocarpus Marsupium (bijasal).

It may be noted that the heartwood of practically all species is far more durable than the sapwood. No species, not even teak, is absolutely immune to white ant attack in India, but the life of most timbers, especially of sapwood, can be prolonged considerably by preservative treatment, with pure creosote or some such toxic substance.

(*c*) *Telegraph posts.*

Any of the strong and durable species in (*a*) and (*b*) above are suitable if obtained in good, long, straight lengths. Telegraph poles should be treated or painted with creosote at the base to lessen insect attack under ground, and should be painted above ground to prevent dry rot at the top of the pole.

(*d*) *Mine props.*

Durability is again necessary, but the main factor is *resistance to compression parallel to the grain*, to enable the timber to stand up under the enormous pressure exerted by the weight of earth it supports. *Heritiera minor* and *Shorea robusta* are probably the best timbers for this purpose, while *Gmelina arborea* has been reported on as making excellent mine props. *Terminalia tomentosa*, *Diospyros Melanoxylon*, *Anogeissus latifolia* and *Hopea parviflora* are also used. Here again, preservative treatment will increase the life of mine props considerably.

(*e*) *Paving blocks.*

The main requisites are *durability*, *resistance to wear and tear*, *hardness*, and *non-liability to absorb water*. The texture should be even, otherwise the blocks wear unevenly. Blocks may vary in size, but they are usually laid with the cross section uppermost. *Xylia dolabriformis* (pyinkado) is probably the best wood for the purpose. *Tectona grandis* is also good. Pyinkado blocks laid in the streets of Bombay and Rangoon lasted 20 years. *Hardwickia binata* has also been used in India and very favourably reported on.

For interior parquet flooring, *Dipterocarpus turbinatus* (gurjan) has been proved exceptionally good and is reputed to be silent to the tread. The Bank of England in London is floored with this wood. *Pterocarpus macrocarpus* (Burma padauk) also makes a very handsome parquet floor, if laid as "herring-bone" parquetting. If there is any danger from white ants, floor blocks should always be treated if the wood used is not naturally durable.

(*f*) *Railway sleepers.*

The requisites are :—

(i) *Durability.*

(ii) *Hardness and toughness.*

(iii) *Non-liability to warp and split.*

(iv) *Good spike-holding capacity.*

The replacements of wooden sleepers in the railway systems of India amount to over 1,000,000 sleepers a year. The untreated woods at present most commonly used are sal, deodar and pyinkado, mainly on account of their availability and durability. Burmese pyinkado sleepers have been known to last 33 years in the line, whereas the lives of sal and deodar are about 16 and 14 years respectively. Teak has been used a good deal in Central India, often in the form of half-round sleepers, but it is now generally considered as too valuable for this work, and the price is usually prohibitive. The question of treating sleepers with various antiseptics must not be overlooked, as their durability is thereby greatly enhanced. A chir pine sleeper, for instance, will only last 2 years untreated, whereas one may expect a life of 14 years or more from a similar sleeper, treated with creosote or other preservatives.

Amongst other sleeper woods at present used in India may be mentioned :—

(*a*) *Untreated.*

Mesua ferrea, *Bischofia javanica*, *Lagerstroemia parviflora*, *Pterocarpus Marsupium*, *Hopea parviflora*, *Terminalia tomentosa*, and *Xylia xylocarpa*.

Except *Mesua ferrea*, none of these timbers has a life of more than 10 years and they should all be treated, if possible.

(*b*) *Treated.*

Picea Morinda, *Abies Pindrow*, *Pinus excelsa*, and *Pinus longifolia* in the North Western Railway system and *Terminalia myriocarpa*, *Cynometra polyandra*, *Eugenia Jambolana*, *Altingia excelsa*, and *Dipterocarpus pilosus* in Assam. Other species are known to

be suitable as treated sleepers, and there is little doubt that such sleepers will play an important part in the sleeper supply of India in the future. Of special interest in this connection is the fact that the sapwood of sal treats readily, while the heartwood does not. As the heartwood is already durable without treatment, this fact opens up a big avenue for thought, as a treated sapwood sal sleeper, either in square form, or as a half-round, would undoubtedly be a first class proposition, so far as the Railways are concerned, and would, in addition, benefit the forest owners considerably, as at present most of the sapwood has to be cut off and left in the forest. Creosoted Douglas fir (*Pseudotsuga Douglasii*) from Canada, and powellised karri (*Eucalyptus diversicolor*) from Australia, are also, at present, imported into India for use as railway sleepers, but there should be no need for this with co-operation between the Railways and the Forest Department.

(c) Other woods likely to prove suitable for use as *treated* sleepers are :—

Dipterocarpus spp. life probably 12 to 14 years.
Shorea assamica life probably 12 to 14 years.
Terminalia tomentosa life probably 16 years.
Terminalia Manii life probably 16 years.
Terminalia paniculata life probably 12 years.
Schima Wallichii life probably 12 years.
Anogeissus acuminata life probably 12 to 14 years.
Lagerstroemia spp. life probably 10 to 12 years.
Eugenia spp. life probably 12 years.
Bischofia javanica life probably 10 years.

Further information on sleeper woods, their treatment and individual characteristics, will be given willingly to any enquirer who writes to the Forest Economist, Forest Research Institute, Dehra Dun, where there is a special Section dealing with this subject alone.

III. Woods used in contact with water.

Under this head are included marine piles, well curbs, water pipes, sluice gates, etc. The chief requirement is *non-liability to decay when exposed to alternate wetting and drying.* Some of the

most durable timbers in the air soon decay if exposed to submersion in water and intermittent drying, whereas others, which out of water may perish at once, will often remain in good condition for years, when completely immersed.

Lagerstroemia species, *Bombax malabaricum*, *Boswellia serrata*, *Mangifera indica*, *Erythrina suberosa* and *Terminalia belerica* are all good examples of this, and rank among the most durable timbers in water, if kept completely submerged.

Other well known durable woods, such as *Acacia arabica*, *Heritiera minor*, *Shorea* species, and *Xylia dolabriformis* are of course also used a good deal for under water work in localities where they grow.

For marine work, resistance to the *teredo* and other marine borers is necessary, but so far no Indian timber has been found to be completely immune against *teredo*. Teak, *pyinkado* and *Lagerstroemia hypoleuca* are resistant for a time, but even these cannot hold out for long against the persistent attacks of the *teredo*. Treatment with creosote prolongs the life of marine structures for some years. Pressure treatment is the best, but an open tank treatment is not without value, provided the end and side penetration is at least $\frac{3}{4}''$ to $1''$. A brush treatment is of little use, unless repeated at intervals. Greenheart had the reputation for being immune to *teredo* attack in India, but this idea has been exploded, It is no more immune than some Indian woods, neither are jarrah and karri.

IV. Woods used in boat and ship building.

Timber used in ship-building is subjected to enormous strains, and is employed under circumstances which tax its durability to the utmost; for this reason it should be *strong and elastic*, *durable*, *and free from defects.*

Teak is probably the best ship-building timber in the world, chiefly on account of its great durability, strength, and freedom from warping and "movement" due to its low shrinkage figure. For these reasons, teak is practically the only timber used by Admiralties for naval work, and the best teak of Burma, known as "Admiralty" teak, is still exported to England for the use of the Navy and other government marine departments.

Oak is also a good ship-building timber, but it contains tannic acid which corrodes iron. Teak also corrodes iron to a certain extent and teak fastenings are usually made of yellow metal or galvanized iron. In India, the timbers mentioned below are among the common shipwright woods.

(*a*) *For the hulls of boats* (other than dugouts), the following timbers are good :—

Acacia arabica, much used for all parts.
Calophyllum Inophyllum. Commonly used in South India.
Dalbergia latifolia. Strong and good for knees.
Dalbergia Sissoo. Largely used. Good for frames.
Dipterocarpus turbinatus. Commonly used in Burma.
Heritiera minor. The best timber for the purpose in East India.
Hopea species. Very strong and durable.
Lagerstroemia lanceolata. The chief boat building wood of South India.
Mangifera indica. Very good for side planking.
Pterocarpus dalbergioides. Very strong and durable.
Shorea species. Very strong and durable.
Xylia dolabriformis. Very hard and good for keels.

(*b*) *Masts and spars.*

The timber in this case must be *long, straight, strong, elastic* and not too heavy. The best examples are :—

Calophyllum tomentosum, the poonspar tree of South India, *Calophyllum Inophyllum*, *Homalium tomentosum* (Burma), *Cedrus Deodara* and *Casuarina equisetifolia*. Large bamboos are also very commonly used for this purpose, especially in country boats.

(*c*) *Oars and helms.*

Oars and helms must be *straight-grained, strong, elastic, and light*. Such timbers as *Casuarina equisetifolia*, *Cedrus Deodara*, *Dipterocarpus* species, *Fraxinus floribunda*, *Grewia* species, *Lagerstroemia* species and *Pinus* species, are all used for this purpose.

(*d*) *Dugouts.*

Dugouts are made by hollowing out a single log, and *non-liability to splitting and cracking* is the chief requirement. Many timbers are used but the selection of a good sound straight log is more important than the species used, so long as the timber is not a bad splitter. *Duabanga sonneratioides* is excellent for dugouts. *Berrya Ammonilla* is a very tough wood which is often used, *Mangifera indica* and *Bombax malabaricum* are also popular, being light and durable under water. They must, however, be kept wet, otherwise they will soon perish.

V. Woods used for joinery and cabinet making.

If asked what Indian woods were used for joinery, in India, one might answer "practically all." Timbers which *season well, work easily* and *are not liable to crack, warp or "open out"* are the best, and good colour, figure, and grain, are necessary for ornamental work. The best and most handsome furniture woods India possesses and which are now fairly well known on the European markets are :—

Dalbergia latifolia, (Bombay blackwood or rosewood).
Albizzia Lebbek, (kokko, or siris). A fine timber resembling walnut.
Pterocarpus dalbergioides, (Andaman padauk). A fine rich looking wood. A good substitute for mahogany.
Chloroxylon Swietenia (satinwood). Often finely figured.
Cedrela Toona (toon). Commonly used for light furniture.
Terminalia tomentosa (selected) (laurel). Often extremely handsomely figured.
Terminalia bialata (Selected) (silvergrey). Usually well figured.
Chukrasia tabularis (chickrassy). Very popular for panels.
Phoebe Hainesiana (bonsum). An excellent light furniture wood. Resembles teak.
Dalbergia Sissoo (sissoo). The best chair wood in India.
Juglans egia (walnut). The burrs are in great demand for veneers.

Pentace burmanica (thitka). Resembles light mahogany.
Pterocarpus Marsupium (bijasal). A popular furniture wood in South India.
C. P. teak. Often very handsomely figured.
Other timbers worthy of note in this connection are :—
Dalbergia Oliveri (tamalan).
Dalbergia cultrata (tulip wood).
Gluta tavoyana (gluta).
Gluta travancorica (gluta).
Melanorrhoea usitata (thitsi).
Swietenia Mahagoni (mahogany). Rather scarce in India.

VI. Woods used for cart and carriage building.

(*a*) *Wheels.*

The hub of a wheel has *to bear great strain,* and *must be hard and tough.* The woods commonly used are *Acacia arabica, Hardwickia binata, Shorea robusta,* and *Xylia dolabriformis.*

(*b*) *Spokes.*

Wood for spokes must be *straight-grained, strong,* and *elastic.* The best are *Dalbergia Sissoo, Dalbergia latifolia,* and *Pterocarpus dalbergioides.*

(*c*) *Felloes.*

Felloes are subjected to much crushing and alternations of wet and dry. They must therefore be *hard, strong, elastic,* and *durable.* Naturally-curved timber or bent timber is better than that artificially shaped. *Dalbergia Sissoo, Dalbergia latifolia* and *Pterocarpus dalbergioides* are the best, while *Shorea robusta* is commonly used in the United Provinces for country carts.

(*d*) *Shafts.*

Shafts are usually made of split wood which should be *tough, elastic* and *very strong.* The best woods are :—
Grewia species, *Homalium tomentosum, Anogeissus latifolia* and other such strong, straight-grained, and elastic woods.

(e) *Railway Carriages and Wagons.*

Up to the present time, teak has been practically the only wood used for railway carriage work, but a movement is now on foot to try and introduce substitutes for this work. *The most important point in this connection, is to get properly seasoned wood*, and for this reason the Forest Research Institute has undertaken the seasoning of small consignments of timber selected by each railway in India. The railways are the largest purchasers of timber which the Forest Department has, and if the railways can be persuaded to use woods other than teak for their carriage work, it will mean a great step forward in the utilisation of our Indian woods. Anyone interested in this subject would be well advised to peruse "The Report on certain Indigenous Timbers of India, Burma, and the Andamans, considered suitable for Railway Carriage Building 1924-25," by H. G. Norman-White. The publication was published by the Railway Board in 1925, and contains much valuable information.

VII. Split wood.

(a) *Cooperage.*

One of the most important uses of split wood is cooperage or barrel making. The industry has two branches namely, "tight" cooperage *i.e.*, barrels used for liquids, and "loose" cooperage, which comprises barrels used for dry goods such as cement, etc. Woods tried for tight cooperage are *Quercus dilatata* which has been found good. *Quercus semiserrata* is also good and *Picea Morinda* is another timber which is said to be excellent.

For loose cooperage, *Odina Wodier*, *Boswellia serrata*, *Soccopetalum tomentosum*, *Bombax malabaricum* and *Tetrameles nudiflora*, have all been used. The last two named have been tried for oil casks and proved excellent.

(b) *Tent pegs, etc.*

The wood used for pegs must be *hard, durable*, and *tough enough to resist hammering*. Amongst those commonly used, the best

are probably *Acacia arabica*, *Heritiera minor*, *Ougeinia dalbergioides*, *Tamarindus indica* and *Zizyphus Jujuba*, but several other species are perfectly suitable, provided the wood is selected properly and seasoned.

(c) *Matches.*

Match splints are either split from peeled veneers or from sliced veneers. Unfortunately, India does not possess *easily available* timbers which are really suitable for making first class match splints, comparable with European aspen. The words "easily available", in the sentence above, denote the chief reason for this. Such timbers as *Picea Morinda*, *Abies Pindrow*, *Alnus nitida*, *Betula utilis*, if obtainable green and free from knots and in suitable sizes, etc., would probably make good matches, but their inaccessibility and consequent high price delivered at the match factory, rules them out.

Match woods must be *straight-grained and cheap*, but unfortunately most of the cheap woods of India have interlocked grain and crooked or spiral growth.

A few plains timbers such as *Bombax malabaricum*, *Excaecaria Agallocha* (Sunderbans), *Trewia nudiflora* and *Boswellia serrata* have been used for some years past for match making, but they give at the best a splint of medium quality.

Papita or *sawbya* (*Sterculia campanulata*) from the Andamans and Burma is very popular with the match factories on the East side of India, and *bakota* (*Endospermum malaccense*), also from the Andamans, is in even greater demand. Both give a fair second class splint. *Sideroxylon longepetiolatum* has also been tried with success.

The best matches are made from imported aspen or from the Japanese *hakuyo*. "Swan Vestas" are made from grooved sugar pine (*Pinus Lambertiana*).

VIII. Woods for packing cases.

Under this head there is a fairly wide choice, as any *light, easily worked and cheap timber* will suit for common packing cases. For special boxes, such as those used in the tea industry, and for packing foodstuffs, the wood should be free from objectional smell, and

tainting propensities, and for this reason such timbers as teak, deodar, etc., are of no value. Tea boxes are now mostly made of plywood, this being strong, light and cheap. Rough packing cases are often made up out of the wood from large deal cases received from Europe, while mango, toon, semul, *Duabanga sonneratioides* and chir pine are some of the commonest Indian woods used for this purpose.

The Andamans are rich in good cheap utility woods, dhup (*Canarium euphyllum*), lambapatti (*Sideroxylon longepetiolatum*), chuglam (*Terminalia bialata*), didu (*Bombax insigne*), papita (*Sterculia campanulata*) and parishia (*Parishia insignis*) being good examples.

Cigar boxes are made in South India from *Cedrela Toona*, *Melia Azedarach*, and *Melia composita*.

IX. Miscellaneous.

(*a*) *Rifle stocks.*

Many timbers have been tried for this purpose but walnut is the only wood so far found which seems to meet with the approval of the Ordnance factories. Other timbers are under trial at the time of writing, and preliminary reports indicate that there is a good chance of woods other than walnut being accepted for rifle parts. The timbers under trial are bijasal (*Pterocarpus Marsupium*) and ainee (*Artocarpus hirsuta*).

(*b*) *Bows.*

Taxus baccata is one of the best woods yet found for bows, and has been used for this purpose in Europe for centuries. In India, *Acacia Catechu*, *Parrotia Jacquemontiana* (Punjab) and *Sageraea elliptica* (Andamans) are among the best of the bow and arrow woods.

(*c*) *Fishing rods.*

In India, for cheap rods, bamboos are chiefly used, the "ringal" (*Arundinaria falcata*) being well known. The high class "split cane" rods are also made of bamboos. *Homalium tomentosum*

and *Caryota urens* are both good rod woods, but it is doubtful if India possesses any wood which can compare with greenheart for rod making. The Forest Research Institute have been experimenting with several woods for this purpose and one or two have shown promise. The best so far have been *Terminalia Manii* (black chuglam), and chooi (*Sageraea elliptica*), but the last named, although extremely strong and pliable, lacks the elasticity of greenheart. European "split cane" rods are usually made from "palankona", a Chinese bamboo, but the male bamboo (*Dendrocalamus strictus*) was at one time the favourite for this work.

(*d*) *Sports requisites.*

Hockey sticks are generally made of ash (*Fraxinus excelsior*) or, in India, of *Morus indica*.

Tennis racquets are made of ash, *Dalbergia Sissoo*, *Juglans regia* and *Morus indica*.

Croquet balls and mallets.—*Buxus sempervirens* is the only wood used.

Cricket bats.—*Salix alba* is the best but *Salix babylonica* is the wood most used for this purpose in India.

Golf clubs.—The chief wood is hickory, though ash is commonly employed. Of the Indian woods, chooi (*Sageraea elliptica*), *Grewia* species, and *Lagerstroemia hypoleuca* (Andaman pyinma) have all been proved perfectly suitable, and clubs made from these woods have been in use for years without any sign of deterioration. For golf club heads, pyinkado has been used successfully.

(*e*) *Tobacco pipes.*

Tobacco pipes are made from the roots of *Erica arborea*, a heath not found in India. Several Indian woods have been tried for this purpose but they all sweated too much and cracked. Knots of dry teak have been used with fair success, while bamboo nodes are employed in Burma for cheap pipes.

(*f*) *Mathematical instruments, rulers, etc.*

These are usually made of boxwood.

Haldu is also good, and other close-grained woods such as *Gardenia* species, *Holoptelea integrifolia* and *Wrightia tinctoria*, if properly seasoned, are eminently suitable for the purpose.

(*g*) *Carving, toys, combs, etc.*

These are made of any cheap close-grained wood suitable for carving such as, *Adina cordifolia*, *Holarrhena antidysenterica*, *Boehmeria rugulosa*, *Wrightia tinctoria*, etc. *Buxus sempervirens* is also popular for combs, but supplies are limited. *Santalum album* is used in the well known sandal wood carvings of Mysore, and this wood holds premier place in the world for carved boxes, etc., on account of its pleasant perfume. Olive (*Olea ferruginea*) has a very attractive marble-like grain which can be shown off to good advantage in small carvings, etc.

(*h*) *Bobbins.*

The only Indian wood so far proved to be a good bobbin wood is *haldu* (*Adina cordifolia*). Others have been tried in England and in India, but they cannot stand up to the high speed turning machines. Most Indian bobbins, pirns, tubes, etc., are made of imported beech and it is doubtful if any Indian timber will be found to take its place.

Picker arms, on the other hand, open up a large avenue for the utilisation of Indian woods. *Anogeissus latifolia*, *Ougeinia dalbergioides* and *Grewia tiliaefolia* should all prove suitable for this purpose.

(*i*) *Musical instruments.*

For sounding boards and bodies of stringed instruments, *a regular and even structure* is required. The timbers used are usually even-grown conifers. In India, many woods are used for making such instruments as tom-toms, "sitars," flutes, etc. Teak, toon, walnut, mulberry and haldu being amongst the commonest, while *Dalbergia Oliveri* (tamalan), *Dalbergia latifolia* (rosewood) and *Pistacia integerrima* are used in Europe for xylophone keys.

(*j*) *Sticks and police batons.*

For walking sticks, an ornamental, fairly strong straight-grained and elastic wood is necessary. Canes, such as *Calamus viminalis* (rattan) and *Calamus latifolius* are popular, while *Diospyros Kurzii*,

Murraya exotica and *Santalum album* are commonly used for carved walking sticks. For police batons, *Cotoneaster bacillaris*, *Parrotia Jacquemontiana* and *Olea ferruginea* are employed, the first named being light but very strong. *Heritiera minor* (sundri) makes a good baton and is used by the police in East India.

(*k*) *Axe and tool handles.*

Woods for axe and tool handles must be *strong and especially elastic to stand continuous blows*. Imported ash and hickory are universally used for this purpose, but the following Indian woods have been tested at the Forest Research Institute and found as good as, if not better than, ash and hickory :—*Anogeissus acuminata*, *Grewia tiliaefolia*, *Parrotia Jacquemontiana*, and *Olea ferruginea*.

(*l*) *Brushes.*

For fancy brush-backs, *Diospyros Ebenum* (ebony), *Chloroxylon Swietenia* (satinwood), *Adina cordifolia* (haldu), *Pterocarpus* species, *Dalbergia* species, and *Carallia integerrima*, are all used.

For household brushes, *Hymenodictyon excelsum* and *Cedrus Deodara*, are the most popular, while *Odina Wodier* is used for military horse brushes.

APPENDIX I.

Forest Research Institute, Dehra Dun.

Index of Timber Strengths stated as percentages of the Strengths of Teak.

Teak=100 in each case.

Species.	Weight relative to Teak (Unseasoned).	Strength as a beam.	Stiffness as a beam.	Suitability as a post or strut.	Shock resisting ability.	Shear.	Hardness.	Shrinkage.
Tectona grandis (Teak).	100	100	100	100	100	100	100	100
Abies Pindrow (Himalayan silver fir) .	75	65	80	75	70	75	55	175
Acacia arabica (babul) . . .	120	115	90	105	175	180	180	145
Adina cordifolia (haldu) . . .	95	80	70	85	80	110	110	..
Albizzia procera (white siris) . .	95	80	80	85	110	115	115	140
Alstonia scholaris (chatiyan) . .	60	50	55	50	35	65	35	130
Anogeissus acuminata (yon) . .	125	115	120	110	130	140	150	200
Anogeissus latifolia (axlewood) . .	130	100	95	90	160	135	160	185
Artocarpus hirsuta (aini) . . .	85	90	90	100	85	85	90	110
Calophyllum tomentosum (poon) . .	90	85	90	85	80	90	80	185
Calophyllum Wightianum (poon) . .	95	85	75	80	100	110	110	190
Cedrela serrata (toon) . . .	80	70	80	75	80	90	75	160
Cedrela Toona (toon)	70	55	55	55	65	80	60	165
Cedrus Deodara (deodar) . . .	80	75	75	75	65	80	60	130
Cullenia excelsa (kaarni) . . .	90	90	100	95	95	75	75	170

Dalbergia latifolia (Bombay blackwood)	125	85	85	75	130	125	120	130
Dalbergia Sissoo (sissoo) . . .	115	90	85	85	130	125	115	135
Dichopsis elliptica (pali) . . .	90	85	100	90	90	85	80	185
Dillenia indica (chalta) . . .	85	75	75	75	80	95	75	195
Dillenia pentagyna (dillenia) . .	90	75	70	70	70	110	90	160
Diospyros Melanoxylon (ebony) . .	115	70	70	70	75	100	95	210
Dipterocarpus alatus (gurjun) . .	95	85	90	75	85	90	80	205
Dipterocarpus pilosus (hollong) . .	100	90	110	95	80	85	90	255
Dipterocarpus tuberculatus (in) . .	120	105	110	95	100	145	130	210
Dipterocarpus turbinatus (gurjun) .	110	100	120	105	80	90	95	215
Grewia tiliaefolia (dhaman) . .	110	105	120	125	..	155	135	..
Heterophragma adenophyllum (pet ari) .	120	115	110	135	..	130	190	..
Homalium tomentosum (Burma lance-wood).	125	110	120	115	..	155	165	..
Hopea odorata (thingan) . . .	105	105	95	105	95	110	140	140
Hopea parviflora (hopea) . . .	135	120	115	125	110	150	200	175
Lagerstroemia Flos-Reginae (jarul) .	85	80	80	75	75	100	110	185
Mesua ferrea (mesua) . . .	135	140	145	150	160	115	185	235
Michelia Champaca (champak) . .	70	70	75	70	80	90	60	125
Michelia excelsa (safed champ) .	75	70	90	75	65	70	55	170
Odina Wodier (wodier) . . .	85	50	50	50	..	75	65	125
Parashorea stellata (Tavoy wood) .	100	90	110	100	..	95	90	..
Pentacme suavis (Burma sal) . .	130	120	125	120	100	125	175	210
Picea Morinda (Himalayan spruce) .	70	55	70	60	60	60	45	170
Pinus excelsa (blue pine) . . .	70	50	60	55	45	65	35	130

APPENDIX I.

FOREST RESEARCH INSTITUTE, DEHRA DUN—*contd.*

Index of Timber Strengths stated as percentages of the Strengths of Teak—contd.

Teak=100 in each case—*contd.*

Species.	Weight relative to Teak (Unseasoned).	Strength as a beam.	Stiffness as a beam.	Suitability as a post or strut.	Shock resisting ability.	Shear.	Hardness.	Shrinkage.
Tectona grandis (Teak).	100	100	100	100	100	100	100	100
Pinus longifolia (chir) . . .	80	60	80	70	70	75	50	185
Pterocarpus dalbergioides (Andaman padauk).	105	105	105	110	95	120	130	100
Pterocarpus macrocarpus (Burma padauk).	125	135	120	125	155	160	200	125
Pterocarpus Marsupium (bijasal) .	110	95	85	90	125	110	110	155
Sageraea elliptica (Andaman bow-wood)	120	125	125	125	210	120	140	205
Shorea obtusa (Burma sal) . . .	145	135	145	145	120	155	215	225
Shorea robusta (sal) . . .	120	115	115	120	120	125	150	200
Stephegyne diversifolia (binga) . .	90	95	85	90	105	110	105	175
Stephegyne parvifolia (kaim) . .	95	75	70	75	105	120	100	170
Terminalia bialata (white chuglam) .	95	95	105	100	95	100	95	195
Terminalia procera (badam) . .	85	75	80	75	85	105	85	160
Terminalia tomentosa (laurel) . .	120	100	100	95	115	110	130	180
Vateria indica (white dhup) . .	80	75	100	85	60	85	60	210
Xylia dolabriformis (pyinkado) . .	130	130	130	145	145	160	175	160
Xylia xylocarpa (irul)	120	100	100	105	90	150	190	190

APPENDIX II.

As intending purchasers of timber often experience difficulty in getting in touch with forest contractors, the following lists have been compiled from information received from the Provinces, in the hope that they may be of some help to timber buyers.

Bihar and Orissa.

List of contractors for timber in Bihar and Orissa:—

1. B. Debendra Nath Dutta, 58-1, Hari Ghosh Street, Calcutta.
2. Messrs. The Bengal Timber Trading Co. Ltd., P. O. Panposh, B. N. Railway, Bihar and Orissa.
3. Messrs. The Central Provinces Timber Syndicate, P. O. Bisra, B. N. Railway, Bihar and Orissa.
4. B. Madho Prasad, P. O. Golkera, District Singhbhum, B. N. Railway.
5. Maulvi Hafij Ahmedullah, P. O. Chakradharpur, District Singhbhum, B. N. Railway, Bihar and Orissa.
6. B. M. L. Biswas, P. O. Chaibassa, District Singhbhum, B. N. Railway, Bihar and Orissa.
7. B. G. B. Mukharji, P. O. Sonua, District Singhbhum, B. N. Railway, Bihar and Orissa.
8. Maulvi Muhammad Khan, P. O. Sambalpur, District Sambalpur (Orissa), B. N. Railway.
9. B. D. N. Bose, P. O. Sambalpur, District Sambalpur (Orissa), B. N. Railway.
10. B. Motiram Basantlal, P. O. Angul, District Angul (Orissa).
11. B. Bidyadhar Jagdev, P. O. Khurda, District Puri.

Bengal.

List of contractors for timber in the Jalpaiguri Division (Bengal):—

1. B. S. C. Ray, P. O. Gairkata, Jalpaiguri.
2. B. R. P. Sarker, P. O. Gairkata, Jalpaiguri.
3. B. J. N. Biswas, P. O. Banarhat, Jalpaiguri.
4. B. A. C. Biswas, P. O. Lataguri, Jalpaiguri.
5. B. J. C. Mukherjee, P. O. Chalsa, Jalpaiguri.
6. B. S. C. Banerjee, P. O. Manabari, Jalpaiguri.
7. B. B. N. Ghosh, P. O. Ramshai, B. D. Railway.
8. Thakur Prasad Sing, P. O. Banarhat, Katalguri Bazar, B. D. Railway.

List of contractors for timber in the Buxa Division (Bengal):—

1. B. A. T. Lahiri, Rangpur.
2. B. S. K. Mazumdar, Mechpara Tea Estate, Kalchini P. O., Jalpaiguri District.
3. B. Ramcharan Agarwalla, Rajabhatkhawa P. O., Jalpaiguri District.
4. B. Girish Chandra Dey, Rajabhatkhawa P. O., Jalpaiguri District.
5. B. J. N. Ghose, Rajabhatkhawa P. O., Jalpaiguri District.
6. B. Rasik Lal Dutta, Rajabhatkhawa P. O., Jalpaiguri District.
7. Mr. Macha Chinaman, Rajabhatkhawa P. O., Jalpaiguri District.
8. B. Mathuresh Roy, Rajabhatkhawa P. O., Jalpaiguri District.
9. B. Ram Kumar Agarwalla, Jainti P. O., Jalpaiguri District.
10. B. D. N. Saha, Narayanganj, Dacca.

List of contractors for timber in the Darjeeling Division (Bengal):—

1. B. Bindeswari Prasad Mishra, Siliguri.
2. Rai Sahib Jangbir Sirdar, Jorebungalow, Ghum P. O., Darjeeling.
3. Gokul Singh Chetri, Chataidhura, Ghum P. O., Darjeeling.
4. B. Sarwan Singh Chetri, Sukhiapokhri P. O. Sukhiapokhri, Darjeeling.
5. B. Ramsevok Mishra, 3rd Mile, Simkona P. O., Lopchu, Darjeeling.
6. Gopal Singh Sirdar, Lopchu, Darjeeling.

List of suppliers of timber in the Kurseong Division (Bengal):—

1. Officer-in-Charge, Government Log Depot and Saw Mill, Siliguri, E. B. Railway, North Bengal.
2. Forest Range Officer, Kurseong Range, Kurseong, D. H. Railway, North Bengal.

List of contractors for timber in the Kalimpong Division (Bengal):—

1. B. Babunandan Missir, Siliguri P. O., District Darjeeling.
2. B. Bindeswari Missir, Siliguri P. O., District Darjeeling.
3. B. Ram Prosan Singh, Siliguri P. O., District Darjeeling.
4. B. Judhabir Gurung, Kalimpong P. O., District Darjeeling.
5. Mr. K. B. Spencer, Kurseong, D. H. Railway, District Darjeeling.

Burma.

List of contractors for timber in Burma:—

Teak. (*Tectona grandis*).

1. Messrs. Bombay Burma Trading Corporation, Ltd., 11, Strand Road, Rangoon.
2. Messrs. T. D. Findlay & Son., Moulmein.
3. Messrs. Foucar & Co., Ltd., 18, Merchant Street, Rangoon.
4. Messrs. Macgregor & Co., Ltd., 43, Phayre Street, Rangoon.
5. Messrs. Steel Bros. & Co., Ltd., P. O. Box No. 132, Rangoon.

Pyinkado (*Xylia dolabriformis*).

1. U Ba Din, No. 6, 45th Street, Rangoon.
2. U Ba Oh, No. 50, Phayre Street, Rangoon.
3. Chan Elliam, No. 40—41, 21st Street, Rangoon.
4. Mr. D. C. Dutta, No. 19, Innis Street, Moulmein.
5. Messrs. Steel Bros. & Co., Ltd., P. O. Box No. 132, Rangoon.

In-kanyin (*Dipterocarpus tuberculatus* and *alatus*).

1. U Ba Din, No. 6, 45th Street, Rangoon.
2. U Ba Pe, 12(*b*), Sule Pagoda Road, Rangoon.
3. Messrs. Steel Bros. & Co., Ltd., P. O. Box No. 132, Rangoon.

Thitya-ingyin (*Shorea obtusa* and *Pentacme suavis*).

1. U Ba Din, No. 6, 45th Street, Rangoon.
2. Messrs. Steel Bros. & Co., Ltd., P. O. Box No. 132, Rangoon.

Burma padauk (*Pterocarpus macrocarpus*).

1. U Ba Din, No. 6, 45th Street, Rangoon.
2. Messrs. Steel Bros. & Co., Ltd., P. O. Box No. 132, Rangoon.

Laurel (*Terminalia tomentosa*).

1. U Ba Din, No. 6, 45th Street, Rangoon.
2. U Ba Si, Sawmill Owner, Zigon.
3. Mr. D. C. Dutta, 19, Innis Street, Moulmein.
4. Messrs. Steel Bros. & Co., Ltd., P. O. Box No. 132, Rangoon.

Yon (*Anogeissus acuminata*).

1. U Ba Din, 6, 45th Street, Rangoon.
2. U Ba Si, Sawmill Owner, Zigon.
3. Mr. D. C. Dutta, No. 19, Innis Street, Moulmein.
4. Messrs. Steel Bros. & Co., Ltd., P. O. Box No. 132, Rangoon.

Thingadu, kaunghmu (*Parashorea stellata*).

1. Messrs. Steel Bros. & Co., Ltd., P. O. Box No. 132, Rangoon.

Yinma (*Chukrasia tabularis*).

1. U Ba Din, No. 6, 45th Street, Rangoon.

Thitka (*Pentace burmanica*).
Thingan (*Hopea odorata*).
Kyana (*Carapa moluccensis*).
Pyinma (*Lagerstroemia Flos-Reginae*).

1. U Ba Oh, General Merchant and Timber Trader, Sinpunit Quarter, Tavoy (Lower Burma).
2. Lim Oo Gaing, Sawmill Owner, Mergui, Lower Burma.
3. Maung Myo Chin, Timber Trader, Sinpunit Quarter, Tavoy (Lower Burma).

For information about all other species.

1. Conservator of Forests, Utilisation Circle, 230, Dalhousie Street, Rangoon.

Assam.

List of contractors for timber in the Nowgong Division (Assam) :—

1. B. Lamba Rai Sirdar, Diphu Railway Station, Dimapur P. O.
2. B. Padma Lal Sirdar, Diphu Railway Station, Dimapur P. O.
3. B. Biradhaj Rai, Nilalung Railway Station, Lumding P. O.
4. Mr. G. C. Bora, Dharamtul Railway Station, Dharamtul P. O.
5. B. Bhakat Singh Punjabi, Jamunamukh Railway Station, Jamunamukh P. O.

List of contractors for timber in the Sibsagar Division (Assam) :—

1. Munshi Sikandar Ali, Jorhat P. O.
2. Mr. Hawkins, Golaghat P. O.
3. B. D. N. Sirkar, Borpathar P. O.

List of contractors for timber in the Lakhimpur Division (Assam) :—

1. The Assam Railways and Trading Co., Ltd., Margherita P. O.
2. The Halcutta Sawmills, Dibrugarh P. O.
3. The Ghoorania Sawmills, P. O. Lapetkata, Dibrugarh.
4. Sirdar Mohan Singh, Digboi P. O.
5. B. Muralidhar Agarwala, Makum Junction, Makum P. O.

List of contractors for timber in the Goalpara Division (Assam) :—

1. B. A. K. Roy, Calcutta and Hultugaon P. O.
2. B. J. C. Chakravarty, Calcutta.
3. B. S. N. Roy, Sapatgram, Eastern Bengal Railway.
4. B. M. N. Guha, Sapatgram, Eastern Bengal Railway.
5. Sherso & Co., Sapatgram, Eastern Bengal Railway.
6. B. J. N. Sirkar, Haltugaon P. O.
7. B. R. K. Gossain, Haltugaon P. O.
8. Dil Dar Hassain Khan, Gorakhpur (United Provinces).
9. Badlu Khan, Gorakhpur (United Provinces).
10. Habibur Rahman, Gorakhpur (United Provinces).

List of contractors for timber in the Sadiya Division (Assam) :—

1. Assam Sawmills and Timber Company, Laimakuri and Murkong Selek.

Punjab and North-West Frontier Province.

List of contractors for timber in the Punjab and North-West Frontier Provinces:—

1. Messrs. Spedding Dinga Singh & Co., Lawrence Road, Lahore.
2. Messrs. Tirath Ram Shah & Sons, Nawanshahar, Hazara District, North-West Frontier Province.
3. Messrs. Sultan Singh & Co., Lower Mall, Lahore.
4. Lala Jodha Mal, Kuthiala, Lakkar Bazar, Simla.
5. Lala Harkishen Lal & Sons, Lahore.
6. Messrs. Hayat & Sons, Sawmills, Jhelum.

Central Provinces.

List of contractors for timber in the Central Provinces:—

1. Jogan Sanker, Chanda, C. P.
2. Raja Ram Singh, Chanda, C. P.
3. Ratan Gopal, Talodhi Road, B. N. Railway.
4. Md. Idriz, Lamta, B. N. Railway, District Balaghat.
5. Bashiruddin Mohammad Homraj, Charegaon, B. N. Railway, Balaghat.
6. Md. Yusuff, Somnapur, District Balaghat.
7. Patru Bhiwa, Balharshah, District Chanda.
8. Madheoji Ramji, Balharshah, District Chanda.
9. Bengal Timber Trading Co., Panposh, B. N. Railway.
10. Thakur Dass Chut, P. O. Kaniwara, District Seoni.
11. Damju Purshattam, Ghansore Railway Station, B. N. Railway, District Seoni.
12. Messrs. Narayan Dass Daulatdin, P. O. Ghoradongri, District Betul.
13. Bejoy Lal Seth, P. O. Ghoradongri, District Betul.
14. Thakur Debi Singh, Itarsi, District Hoshangabad.
15. Har Charan Ram Gulam, Itarsi, District Hoshangabad.
16. Mr. Hanskumar, Manager, Rajabarari Estate, Timarni (G. I. P. Railway), District Hoshangabad.
17. Chuni Lal Hazarilal, Itarsi, District Hoshangabad.
18. Nadir Shah, Md. Karim Khan, Timarni (G. I. P. Railway), District Hoshangabad.
19. Sheoji Punja, Howbagh (B. N. Railway), Jubbulpur, C. P.
20. Muzzamil Hussan, Gowari-ghat (B. N. Railway), Jubbulpur, C. P.

Madras.

List of contractors for timber in the Madras Presidency:—

1. Khan Sahib V. K. Unnikammu Sahib, Olvakkot.
2. M. R. Ry. K. G. Ponnappa Nadar Avl., Olvakkot.
3. B. S. T. Mudaliar, Timber Merchant, Kallai.

4. Veerankunhi and Sons, Timber Merchant, Kallai.
5. K. V. Assankoya Hajee, Timber Merchant, Kallai.
6. The New Malabar Timber Yards and Saw Mills, Kallai.
7. The Standard Furniture Co., Ltd., Kallai.
8. Khan Bahadur Haji Alli Barami, Calicut.
9. S. V. Abu Bucker, Calicut.
10. P. S. Mammukoya Hajee, Calicut.
11. M. Pakku Hajee, Calicut.
12. P. Kander, Calicut.
13. P. Pokker Ali, Calicut.
14. Messrs. Parry & Co., Agents (The New Malabar Timber Yards and Saw Mills, Ltd., Kallai), Calicut.
15. V. Kadiri, Timber Merchant, Ballapatam.
16. T. P. Mammoo, Tellicherry.
17. Persotamaseth, near F. N. Heerji & Co., Cannanore.
18. Sri Lakshmi Mills, Kasaragod.
19. K. P. Ramunni, Bunder, Mangalore.
20. Timber Mosline Trading Co., Bunder, Mangalore.
21. Udipi Manjunatha Sheriyar, Coondapur.
22. Lala Meah Sahib Bahadur Khan Majjid, Cuddapah.
23. Abdulla Khan, Bruce Street, Bellary.
24. P. S. Viswanatha Iyer, East Gate, Tanjore.
25. Narayanaswamy Pillai, Tanjore.
26. Krishnayan Poojan "The Malabar Timber Trading Co.", Trichinopoly.
27. Ponnuswamy Pillay and Sons, Trichinopoly.
28. Gopal Pillay, Trichinopoly.
29. N. Shaik Abdulla Sahib, Shevapet, Salem.
30. M. Ramaswamy Chettiar, Shevapet, Salem.
31. V. Ramaswami Chetty, Shevapet, Salem.

NAMES OF OTHER TIMBER MERCHANTS.

32. B. Krishnaswamy Naidu, Avanasi Road, Coimbatore.
33. M. Moideen Pichi Rowther, Hall Road, Coimbatore.
34. M. Krishnaswamy Pillay, Pollachi.
35. A. Krishna Chettiar, Pollachi.
36. S. S. Venkatrama Chettiar, Pollachi.
37. Mr. Billimoria, Timber Merchant, Ootacamund.
38. Kotta Sagasid Garu, Kottalingalu, Rajahmundry.
39. Tirumalsetti Nagabushanam, Satyanarayanapuram, Bezwada.
40. Gopu Balakrishnayya, near Railway Station, Bezwada.
41. Sinna & Co., Guntur.
42. Anantha Kondia Chetty, Kurnool.
43. A. Govindarajamudaliar, Arcot Road, Vellore.
44. Mr. T. S. Neelakantiah, Lakshmi Vilas, Agarahar, Mysore.
45. T. S. Kandaswamy Pillai, Sivarampet, Mysore.

46. Mr. M. Narasinga Rao Sindhe, near Railway Station, Vontikuppal, Mysore.
47. M. Krishna Rao, Bangalore.
48. B. Arsoji Row, near Kengaraigate Police Station, Bangalore.
49. Haji Sir Ismail Sait, Champion Reef, Kolar Gold Fields, Bangalore.
50. Messrs. Ahmed Sahib and Muhammad Kabir Brothers, Nanjangud, Nanjangud.
51. Palani Pichi Reddi, Nellore.
52. K. Abdul Aziz Sahib, Kucheri Road, Vaniambadi.
53. A. S. Kandaswami Nadar and Sons, Madura.
54. K. L. T. Shunmugam Pillay, Madura.
55. S. K. Bros., Kumbakonam.
56. V. Krishnamurthy Ayyar, Kumbakonam.
57. S. K. Bros., Mayavaram.
58. V. Krishnamoorthy Ayyar, Mayavaram.
59. Kolandappa Chettiar, Cuddalore.
60. S. Govindaswamy Chetty, Panrutty.
61. K. Ponnuswamy Pillay, Pondicherry.
62. V. Ramaswami Mudaliar, Bavapeta, Conjeevaram.
63. Narayanaswamy Mudaliar, Theradi, Conjeevaram.
64. Mr. Shanmugam Pillay, Kalladakurichi, Trichinopoly.
65. Messrs. Ravana Mana Subbu Mudaliar & Sons, Trichinopoly.
66. Senthinadar, Virudanagar, Ramnad.
67. Veerabadra Nadar, Sivakasi.
68. Venkeet Raja, Rajapalayam.
69. P. Butchi Patro, Russelkonda, Ganjam.
70. Ambatti Suryaprakasa Row, Cocanada.
71. Koya Appalaswamy, Cocanada.
72. Abdul Gaffoor Sahib, Palmaner, Chittoor.
73. Gordon Woodroffe & Co., Madras, Madras.
74. The Bombay Co., Madras, Madras.
75. Messrs. Parry & Co., Madras, Madras.

United Provinces.

All enquiries regarding timbers growing in the United Provinces should be addressed to the Divisional Forest Officer, Utilisation Circle, Bareilly, U. P., who will be pleased to supply information to all enquirers regarding sources of supply, outturn, prices, etc.

MGIPC—M—III-2-15—23-10-29—2,000